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PROGRESS REPORT ON RESEARCH IN HOME ECONOMICS

Including Work in United States Department of Agriculture
and Cooperative Studies with
The State Experiment Stations

* * * *

This Progress Report is a "tool" for: (1) Advisory Committee use in formulation of recommendations in regard to present and future programs; (2) Administrative use in program development, coordination and evaluation. The material in this Report is not for publication. The report includes research findings that have already been released. When mention is made of these findings, the publication containing the public release is also cited. Any reference to published findings should mention the publication in which the release was made, not this Progress Report. Included also are many tentative findings that have not been sufficiently tested for public release. When results are ready for release, the information will be made available through established channels.

For the reasons given, copies of the Report are available only to research administrators and workers directly concerned with the development and conduct of the program and to advisory committee members. Those receiving it are asked to observe strictly the limitation: "Administratively Confidential -- (Not to be Quoted or Copied)."

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UNITED STATES DEPARTMENT OF AGRICULTURE
Washington, D. C.
November 1956

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UNITED STATES DEPARTMENT OF AGRICULTURE
Washington, D. C.
November 1948

FUNCTIONS OF ADVISORY COMMITTEES

The Home Economics Research Advisory Committee is one of a number of committees authorized by Congress in 1946 to advise the Department of Agriculture with respect to specific research and service programs.

The committees have been asked to consider all of the research and marketing service work of the Department in their respective fields. This is in recognition of the value the Department places upon the advice and counsel received and is in accord with suggestions of Congressional committee members who are directly concerned with the work.

These committees are performing an important function in advising with respect to the development of the Department's research and marketing service programs. However, it is recognized by members of Congress, committee members, and the Department that the implementing and administering of these programs are the responsibility of the Department.

The functions of the advisory committeemen include:

1. Acquainting themselves with the problems of consumers, producers, all segments of the industry and of other groups, and presenting them for committee consideration.

2. Reviewing and evaluating the current research and marketing service programs of the Department, including work under way at Federal laboratories and field stations.

3. Recommending adjustments in the Department's program, including priorities for new work and expansion of work under way.

4. Developing a better understanding of the nature and value of the agricultural research program, explaining it to interested persons, groups and organizations and encouraging the wider and more rapid application of the findings of research.

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HOUSEHOLD ECONOMICS

COOPERATION

Much of the research on home economics covered in this report is conducted in cooperation between agencies of the United States Department of Agriculture and the State Experiment Stations. The studies find their origin in problems of producers, processors, distributors and consumers, and representatives of these groups frequently participate in the cooperation. Cooperative programs are jointly planned and conducted in a manner to make full use of the personnel and resources of each participating group with the minimum of duplicative effort. The results of cooperative research are jointly prepared in the form of uniform recommendations.

* * * *

SYMBOLS USED TO DESIGNATE REPORTING AGENCIES

ARS -- Agricultural Research Service

ADP	--	Animal Disease and Parasite Research Branch
AE	--	Agricultural Engineering Research Branch
CH	--	Clothing and Housing Research Branch
ENT	--	Entomology Research Branch
DH	--	Dairy Husbandry Research Branch
HC	--	Horticultural Crops Research Branch
HHE	--	Household Economics Research Branch
HN	--	Human Nutrition Research Branch
SU	--	Southern Utilization Research Branch
SWC	--	Soil and Water Conservation Research Branch

AMS -- Agricultural Marketing Service

MD	--	Market Development Branch
MOC	--	Market Organization and Costs Branch
SHR	--	Statistical and Historical Research Branch

FES -- Federal Extension Service

* * * *

TEXTILES AND CLOTHING

I. FABRIC QUALITY AND UTILITY

A. Progress on Work Under Way

1. Literature Review of Physical, Chemical and Other Properties of Fabrics in Relation to Serviceability in Actual Use CH

A compilation of research data on fabric quality has brought together results of investigations of properties and serviceability of 1,354 different household and clothing fabrics classified under 26 categories. The data, selected from studies made by the Department, by Agricultural Experiment Stations, and by colleges and universities engaged in textile research, furnish a basis for recommending acceptable qualities for certain fabrics, and point out gaps where further research is needed.

Data are most extensive for broadcloth, percale, sheeting, and toweling made of cotton, and for blanketing made of cotton and wool. Data are sparse for other staple materials such as serges, print cloth made of manufactured fibers, and blends made of manufactured and natural fibers. The compilation showed, however, that to provide data on textile performance, more research is needed to identify the type of fabric that will best meet specific home or institutional needs. More in-service studies should be conducted along with laboratory determinations of the fabrics' physical properties so that relationships between them can be determined.

Plans: The compilation has been published and the resulting information is serving as a basis for planning new research.

2. Facts on Present-day Fabrics, Fibers and Constructions CH

Information on present-day clothing fabrics -- based on data from textile researchers, dry-cleaners, fiber and fabric manufacturers, as well as consumers -- has been brought together for a publication "Clothing Fabrics - Facts for Consumer Education." This bulletin is planned to provide source material for Extension workers, teachers, and other leaders and to help the average purchaser in judging fabrics for quality, wearability, and suitability for specific purposes. Information is provided on the fibers used, fabric construction and designs, and finishes applied to impart specific characteristics.

Plans: No further work on this project is planned.

3. Physical Properties and Serviceability of Serge Trousers Made from Domestic Wools CH

Serge trousers made from wools relaxed at three different stages of processing were made into trousers and worn to determine whether actual in-service produced evidence of advantages of such relaxing in the stages of rovings and yarn as compared with direct processing. Results show that trousers worn until the wearers considered them unsuitable for further service still retained more than half their original bursting strength and that relaxing did not affect the wearability.

Alkali solubility method of measuring deterioration proved unreliable as a means of evaluating wool degradation caused by wear. However, microscopic studies of the original fabric and of the worn sections of the trousers revealed that as the hours of wear increased the total number of fiber ends per inch increased and the ratio of damaged to undamaged ends increased. The use of this measure as a basis of comparison of laboratory and actual wear abrasion is being explored.

Plans: Statistical analyses of the data will be made in order to attempt to correlate visual judgment of garment condition, residual bursting strength of the worn garments, and number and condition of fiber ends in worn sections of the trousers. The rate of deterioration will be determined from the data obtained from testing garments withdrawn at various intervals of service. A report will be prepared giving the results of this study.

4. Physical Properties of Broadcloth, Twill and Sateen Shirtings, and Serviceability of Shirts as Related to Yarn and Fabric Construction CH

Serviceability studies of shirts made from five cotton shirtings with varying counts, weaves, and yarn sizes (specifications formulated by CH and SU) are being carried out cooperatively with Gallaudet College, Washington, D. C. This research is part of an investigation to determine the relation of yarn and fabric construction to fabric quality and to correlate laboratory evaluation with actual service. Three hundred shirts reached 24 wearings and launderings during the school year, 1955-56. Evaluations of shirts withdrawn after 12 launderings have shown as much as 50 percent loss in tearing strength. No distinct differences in durability among the five fabrics are evident after 12 wearings.

Plans: The in-service studies will be continued until the shirts are no longer acceptable to the wearers. A paper reporting the findings will then be prepared.

5. Physical Properties of Whipcords, and Serviceability of Trousers, Made from Medium and Coarse Wools CH

In studies to determine the usefulness of medium and coarse domestic wools for utility clothing, six experimental whipcord suitings were used, namely: two all-wool fabrics, one made from 64's and the other from 56-58's; two made from 75% wool-25% nylon blends, 56-58's and 48-50's; and two from 75% wool-25% rayon blends, 56-58's and 48-50's. These six fabrics were chosen from the 25 exploratory fabrics reported in USDA publication HNHE-104, "Physical and chemical characteristics of suiting fabrics composed of wool, and wool combined with mohair, nylon, and rayon." An equal number of trousers were made from each suiting. Serviceability findings to date indicate the possibility of using the coarse wool in work clothing. 48-50's wool, seldom used for clothing, when blended with rayon or nylon, produced fabrics acceptable to truck drivers in the D. C. area, who are wearing the trousers as part of a serviceability test. During four winter seasons, the trousers have now reached 60 weeks of actual wear by the truck drivers and have had 60 dry cleanings.

Plans: Laboratory analysis of the fabrics in the worn trousers will be conducted and a report prepared.

6. Geometry of Knit Fabrics in Relation to Physical Properties CH

Research to determine the relationship of the knit fabric construction to fabric characteristics has produced data for the first time on the stitch length of tricot fabrics with various runner ratios. Ninety-seven fabrics of the two-bar pattern knit of acetate and viscose yarns were analyzed. Lengthwise, as course spacings increased from 18 to 25 mils, the breaking strength decreased between 2 and 7 pounds and the elongation at break decreased between 10 and 15 percent; as the runner ratios increased from 11/10 to 3/2, breaking strength decreased as much as 10 pounds and the elongation at break decreased as much as 10 percent. Widthwise, with the same range of increases in course spacings as above, breaking strength decreased as much as 15 pounds; with the same range of increases in runner ratios elongation at break increased as much as 15 percent. Fabrics with the lower runner ratios (11/10, 6/5, 5/4) were approximately equal in bursting strength and exceeded those with the high runner ratios (7/5, 3/2, 8/5) by as much as 5 to 20 pounds. Examination of the specimens showed that those with high bursting strength broke neither perpendicular nor parallel to the wales. The rupture was at an angle with the wales which varied between 30° and 45°. Fabrics with a wale-course spacing ratio equal to approximately 1.2 were not distorted and shrank or stretched less than 10 percent in laundering. An article, "The geometry and properties of two-bar tricot fabric," reporting the results of this study, has been accepted for publication in Textile Research Journal.

Cooperation has continued with Committee D-13 of the American Society for Testing Materials in developing test methods for knit fabrics. At present, work is under way in formulating a method for measuring the restorability of knit fabrics after laundering.

Plans: Research will be continued on tricot knit fabrics as well as other types of knitting commonly used for under- as well as outerwear.

7. Physical Properties of Cotton Floor Coverings CH

The resistance to soiling and the behavior in cleaning of cotton broadloom floor coverings, with and without soil retardant treatments, are being studied under actual use conditions and with commercial cleaning and application of retardants. Among factors being considered are the degree of soiling after specific periods of wear and cleaning, the period of maximum soil, and the color changes as measured by laboratory determination and visual appearance judged by a panel of staff members.

One hundred sixty-eight specimens of floor coverings, including four hues, representative of three manufacturers, have been in service and cleaned for six wear periods of two days each. The rugs sewn into runners, are placed in front of the counter in the Beltsville cafeteria where approximately 350 persons per day are served. The rugs have been washed by two methods, in a revolving wash wheel and tumbled dried, and by a reciprocating brush and air dried. The rugs with finishes are more resistant to soiling as shown by both visual appearance and laboratory measurements. Those laundered in the wash wheel exhibited a greater color change and shrank between 1 and 2 percent more than those laundered by the reciprocating brush.

Plans: This work is continuing with special emphasis on laboratory and visual measurements of the effects of cleaning on certain hues of floor coverings, using the same chroma and value of known vat and direct dyes.

8. Comparative Study of the Results of Laboratory and In-Service Evaluations of Slip Cover Fabrics CH

Thirty-four fabrics -- 18 cottons, 3 linens, 2 silks, 4 nylons, 4 Dynels, 3 rayons -- made into slip covers for chairs and put into service in the Beltsville Log Lodge Cafeteria in April 1954, have been in continuous service since that date. These articles are inspected daily, removed for laundering when needed, and returned to service. The fabrics are observed for changes in appearance, crease and wrinkle resistance, and slippage of yarns. With the exception of one lightweight cotton and one lightweight rayon, there is no visible evidence of abrasive wear. The fabrics

have been in service and laundered under conditions of subdued light with little reflection, and most of them show little, if any, loss of color.

Plans: The in-service investigations will continue until the fabrics are worn out when the findings will be reported.

Publications: CH

"Properties and Serviceability of Selected Household and Clothing Fabrics. Bibliography and Review of Research Findings, 1928-1951." H. M. Fletcher and S. H. Roberts. Agr. Inf. Bul.-147, May 1956.

"The Geometry and Properties of Two-bar Tricot Fabrics." H. M. Fletcher and S. H. Roberts. Textile Res. Jour. (In Press.)

"Clothing Fabrics - Facts for Consumer Education." M. Smith. Agr. Inf. Bul.-157 (In press)

B. Proposals for Committee Consideration on

I. FABRIC QUALITY AND UTILITY

(Order of Listing has no Priority Significance)

A. Improved Methods to Determine Fabric Serviceability -- Expand research to develop improved methods for determining fabric serviceability.

There is practically no evidence in the scientific literature which relates results of physical and chemical tests on fabrics to their performance in use with respect to such properties as appearance, durability, comfort, function and care throughout the service-life. This is doubtless due to difficulties inherent in testing fabrics during their use as garments or household textiles, such as the long-term nature of the research and the fact that to establish a relationship at different stages of use, such tests require the sacrifice of a specimen garment or textile article. Procedures are urgently needed that would permit successive use and laboratory testing throughout the service life of an experimental fabric. New laboratory tests are needed which would simulate in-service degradation. (1/15)

B. Improved Dimensional Stability and Elastic Properties of Knit Fabrics -- Expand research such as has been done on constructions of plain knit and two-bar tricot fabrics in relation to functional properties to include other commonly used types of knit fabrics such as interlock, raschel and milanese.

From experimental fabrics knit in different constructions, properties such as dimensional stability, strength, elongation, and elastic recovery, should be determined and related to the geometric factors such as wale and course spacings, diameter of yarn, and stitch length. It is hoped to develop principles of fabric behavior which, if applied by manufacturers, would result in knit fabrics of superior quality for various consumer uses. (3/15)

C. Fabric Construction in Relation to Serviceability of Shirting Fabrics -- Expand research to determine the effect of yarn and fabric construction upon the properties and performance-in-use of cotton shirtings.

Fabrics should be woven in a wider range of constructions in order to sufficiently evaluate the yarn and fiber combinations in terms of the fabrics' weight, strength, resistance to abrasion, and tearing. Shirts should be manufactured from these fabrics and placed in service to determine their ability to maintain appearance and to withstand repeated launderings and wear under normal use conditions. A wider range of fabrics in each weave construction would make possible analyses of the inter-relationships between yarn and fabric and provide a basis for determining the correlation between laboratory and wear data. (9/15)

D. Fabric Construction in Relation to Serviceability of Floor Coverings -- Expand the present study of serviceability of floor coverings (now limited to cotton broadloom) to determine the reaction to in-service wear and professional cleaning of tufted wool floor coverings, made from varying amounts of apparel wool blended with scarce classical wools commonly used by manufacturers of floor coverings.

Pre-war wool floor coverings were largely made from blends of Asiatic wools and crossbred of 40's or coarser. The classical Asiatic wools included the coarse wools from native or unimproved sheep. The supply of these wools has been declining and the major rug manufacturing countries of the world are competing in a market of low supply. As a result some carpet manufacturing countries are tending to use apparel wool finer than 40's to supplement the classical Asiatic ones. No information is available on the effect of wear and cleaning on these floor coverings. Research is therefore needed to provide such information on floor coverings made from various specified combinations of apparel and carpet wools. (14/15)

II. CLOTHING REQUIREMENTS AND CONSTRUCTION

A. Progress on Work Under Way

1. Safe and Efficient Clothing for Homemakers Partially Disabled by Age or Chronic Crippling Ailments CH

A review of literature pertinent to clothing problems of the physically disabled indicates that many disablements, whether caused by disease, accident, or advanced age, present similar problems and require the same types of prosthetic aids. Therefore, first consideration in this study is being directed to the requirements of homemakers with ambulatory disablements.

Agencies concerned with problems of handicapped homemakers are being contacted for information and such aid as they are prepared to contribute. Cooperation for observational and experimental work has been offered locally by the American Federation of the Physically Handicapped. Counsel and assistance have also been extended by other interested organizations. Fabrics are being sought that will contribute functional qualities to meet such needs as physical comfort, safety, and the conservation of energy.

Plans: Case studies on a few partially disabled subjects will be made in preliminary planning for a more detailed investigation of clothing requirements. On these findings experimental work will be developed.

2. Economics of Household Production of Clothing and Textile Articles CH

The laboratory phase of a study carried on cooperatively with HHE has been completed to determine the relative time and money costs of home production of cotton dresses similar in style, quality of construction and fabric to ready-made dresses, purchased at retail following specifications of the Bureau of Labor Statistics.

Money savings from making women's cotton daytime dresses from commercial patterns, sizes 14 and 20, averaged approximately $5 per dress over the cost of similar ready-to-wear, and required an average total construction time of three hours. Money savings in making girls' cotton dresses from commercial patterns size 8 averaged $2; the total construction time averaged two hours. Thus, the money savings from home construction of clothing are substantial in relation to the amount of time used, provided the housewife has the necessary sewing skill.

Plans: The laboratory phase of this project has been completed and no further work is contemplated. Articles reporting results of the study will be prepared in cooperation with HHE for publication in professional magazines.

3. Home Construction of Clothing CH

Recently completed was a final segment of a project on simplified clothing construction. This involved a study of the relative value of pin and thread basting on six common but relatively difficult clothing construction processes, using as an operator an experienced, skilled seamstress. Analysis of the results showed that in four of the processes studied, the pin-basting method required an average of 2.7 minutes whereas the thread-basting method required an average of 3.9 minutes. In the other two cases, the pin-basting method required an average of 4 minutes; the thread-basting method required a little less time, an average of 3.4 minutes. When the latter method was used, from 1/2 to 3/4 of the total time was used in putting in and removing the basting threads.

In all of the cases studied, thread-basting facilitated machine stitching so that average stitching time was reduced by one-sixth. Comparison of the appearance of the finished product showed that in each case the thread-basting method produced results superior to the pin-basting method. A report of this study has been accepted by the Journal of Home Economics for publication. Information from another phase of this project has served to answer inquiries from homemakers on the problem of straightening fabrics for sewing. A correspondence aid has been prepared on this subject.

Plans: Studies soon will be initiated to determine the durability of different seams and edge finishes in relation to fabric composition, structure, quality, and functional finishes or special properties. (See last year's recommendation 6/15)

Publications CH

"Estimating Money Savings and Time Costs of Homemade Cotton Dresses." In Rural Family Living, pp. 8-16, April 1956.

"Men's Suits: How to Judge Quality." C. L. Scott. Home and Garden Bulletin 54. (In press.)

"A Comparison of Pin and Thread Basting in Clothing Construction." M. Smith. Journal of Home Economics. (In press.)

B. Proposals for Committee Consideration on
II. CLOTHING REQUIREMENTS

(Order of Listing has No Priority Significance)

E. Physiological Requirements of Clothing -- Expand research to determine the effect of fabric composition and structure, clothing design and construction on comfort and function.

Clothing for utility purposes is frequently hampering because of its design, fabric, or workmanship. The result of this is loss of worker efficiency, and clothing waste. Studies should be made for determining clothing requirements in relation to body mechanics and muscular function. In view of increased public acceptance and appreciation of comfort in clothing, the results of this research would contribute to the manufacture of readymade clothing and commercial patterns used by home sewers. (2/15)

F. Sizing and Serviceability of Shoes -- Initiate research on foot measurements essential to the improved sizing of shoes and on factors essential to shoe serviceability.

More adequate data than now available should be obtained on contours, heights, lengths and widths as well as articulate parts of feet of different types to provide manufacturers of footwear with measurements necessary to proper foot development and comfort. The relative durability of various types of shoes and their component parts should also be determined as a basis for recommending to manufacturers and consumers those qualities needed for more satisfactory performance. This research should include studies of properties of materials from which shoes are made, protective materials and procedures for cleaning and preservation, and practical guides for evaluating such qualities as resistance to abrasion, moisture, and bacteriological action.

In carrying out these studies the cooperation and advice of other research organizations and manufacturers would be solicited. Examples of those who assisted or manifested interest in an earlier exploratory study on shoe sizing are the Office of Quartermaster General, Eastern Utilization Research Branch, Orthopedic Laboratory of United Shoe Machinery Company, United Last Company, and Antioch College. (5/15 and 7/15)

G. Clothing for Children -- Initiate research to develop functional clothes for pre-school children.

The inter-relation of design, fabric, and workmanship would be considered along with recent knowledge of children's abilities at various ages. Thus, principles resulting from earlier work would be broadened and brought up to date. This research would lead to the revision of Farmers Bulletin 1778, "Fabrics and Designs for Children's Clothes," issued in 1937. (8/15)

III. FABRIC CARE

A. Progress on Work Under Way

1. Laundering Fabrics: Effect of Laundering Reagents and Washing Procedures on Fabric Properties CH

In research aimed at improving home washing practices, three phases of laundering have been or are being investigated: (1) the soil-removing efficiency of detergents; (2) the effect of detergents and washing conditions on fabric properties; and (3) methods for whitening and maintaining whiteness in fabrics. Using small swatches of test fabrics and a laboratory-type washer designed to handle many samples simultaneously for rapid evaluation of variables important in home washing, the first study determined the ability of some 50 detergents, of types widely available for household use, to remove soil from various fabrics of cotton, wool, and man-made fibers under different conditions of temperature, time, water hardness and amount of agitation.

Next investigated were the changes that occur in certain properties of fabrics upon repeated laundering with the detergents by the various washing methods. Measurements were made of the amount of shrinkage, changes in weight and breaking strength, departure from whiteness (towards grayness and yellowness), and chemical modifications (indigo carmine absorption, fluidity in cuprammonium hydroxide and acetyl determinations) of the fabrics due to laundering.

In the third phase the methods for whitening fabrics under consideration were the use of fluorescent dyes (presently included in most household detergents) and the application of sodium perborate bleaches available to homemakers.

Laboratory procedures were established and a special instrument developed whereby such fluorescent and nonfluorescent whitening effects could be evaluated. To date, the whitening effects and the amount of chemical damage produced in cotton test fabrics due to laundering with the various bleaches have been measured.

The results of these laboratory evaluation studies using small samples of fabrics were the basis for a related project in which naturally soiled cotton fabrics (sheets, pillow cases, huck towels, terry towels, tea towels, place mats, and T-shirts) were washed and dried in modern household equipment. The data obtained from both projects -- after comparable use of the laboratory-type washer and the modern washing machines -- showed that the small-scale laboratory equipment can be used for predicting the effect of laundering conditions in actual use.

Plans: Present-day fabrics of different fiber types, weights, constructions and finishes are being studied for launderability using various reagents and conditions, as a basis for recommending home laundering methods for such materials. White fabrics suitable for blouses and lingerie are being considered first. This phase of the research, given high priority by HERAC in July 1955, was initiated in January 1956.

2. Home Use of Germicides in Disinfection of Clothing (A review) CH

Many compounds are on the retail market to disinfect, sanitize and deodorize fabrics, and to impart to fabrics bacteriostatic properties. Studies have been under way to investigate bacteriologically and chemically the problems incident to the use of various types of disinfectants on fabrics of different composition.

Problems unique to laboratory study of the use of germicides on fabrics are size of fabric specimen suitable for aseptic techniques, volume of disinfectant simulating home and commercial practices, choice of suitable test organisms, realistic contamination in terms of numbers of bacteria, the ratio of the weight of fabric-volume-concentration, and the criteria for sanitization, disinfection, and bacteriostasis.

Studies have revealed both the disinfecting and sanitizing (99.9 percent reduction of numbers of bacteria) dilutions of five quaternary nitrogen compounds at two temperatures for cotton contaminated with one test organism. By increasing numbers of contaminating bacteria increasing concentrations of germicides were needed. A comparison of a quaternary and a chlorine compound as disinfectants for wool and cotton, under varied conditions of time, temperature, and test organisms showed that the former was better for wool and the latter for cotton. The adsorptive capacity of fabrics of differing composition for the two germicides was determined by assaying chemically the amounts of the agents removed from solutions, thus revealing why relatively high concentrations are needed for fabric disinfection. Wool adsorbed more quaternary germicide than cotton.

In addition to disinfecting and sanitizing fabrics, quaternary ammonium compounds are also used to render fabrics bacteriostatic during use. By keeping the weight of the fabric constant and varying the weights, volumes, and concentrations of the bacteriostatic agent, the most economical ratio of germicide-fabric-volume has been determined.

Publications based on research related to the use of germicides to render fabrics bacteriostatic, have resulted in an invitation to serve on the Antimicrobial Committee of the American Association of Textile Chemists and Colorists. Test methods proposed by various members have recently been subjected to laboratory evaluation and procedures developed in this laboratory for testing antibacterial finishes on fabrics have been presented for consideration by the Committee in their search for standard test methods.

Advertising claims that a soap of nationwide distribution would "kill most common germs" were evaluated in our studies using ten "common germs." Findings of our study proved the claims unreliable and the advertising ceased.

Plans: Future studies will relate to the efficacy of inorganic fluorides as bactericidal agents for fabrics.

3. Stain Removal from New Types of Fabrics CH

Laboratory work concerned with problems of stain removal has been completed and a manuscript reporting the findings is in preparation as a revision of Farmers' Bulletin No. 1474, "Stain Removal from Fabrics: Home Methods."

New material contained in the manuscript includes methods for removing stains from the newer man-made fiber fabrics and fabrics with special finishes, and information on the effect of stain removers on these fabrics; methods for removing additional stains from all fabrics; changes in methods given for removing some of the stains in the present bulletin, making use of new products now available to homemakers; improved techniques for using stain removers; and more emphasis on the hazards involved in the use of organic solvents.

Inquiries from homemakers led to investigation of the removal of plastic from garments that had been exposed to moth preventives while hanging on plastic hangers in a closed garment bag. It was found that some plastics are softened by paradichlorobenzene vapors and that the effect is more pronounced at higher temperatures. At hot attic temperatures (130°F) the plastic may become so soft within a few hours that drops of what appears to be melted plastic adhere to the garment (the plastic itself does not melt at this temperature). At 80°F the pastic softens gradually over a period of months if the surrounding air remains saturated with paradichlorobenzene vapors. Although the plastic can be removed by a number of organic solvents, trichloroethylene, because of its nonflammability, is recommended for home use.

Plans: No further work is planned on stain removal.

Publications: CH

"Detergents for Home Laundering." M. S. Furry. Home and Garden Bul. 49. July 1956.

"Measuring the Whitening Effects of Fluorescent Dyes and Perborate Bleaches on Cotton." M. S. Furry and P. L. Bensing. Amer. Dyestuff Reptr. 44 (23): 786-790. Nov. 7, 1955. (Paper presented at national meeting of the Amer. Assoc. of Textile Chem. and Colorists, Sept. 1955.)

"The Protective Effect of Glycine Against the Inhibition of Urease by a Quaternary Germidice." M. T. Goldsmith. Jour. Pediat. 48(4): 473-476, April 1956

"The Effect of Quaternary Treatment under Varied Ratios of Weight-Volume-Concentration on the Bacteriostatic Property of Fabrics." M. T. Goldsmith, M. A. Latlief, J. L. Friedl, and L. S. Stuart. Appl. Microbiol. 4 (2): 91-94. March 1956.

"The Effect of Amino Acids on the Inhibition of Jack Bean Urease by a Quaternary Germicide." (Abstract.) M. T. Goldsmith, F. M. Richardson, and M. A. Latlief. Bacteriological Proceedings 1956, M-121, p. 101. (Paper presented at National meeting of Soc. Amer. Bacteriologists, May 1956.)

"Stain Removal from Fabrics with Special Finishes." Corresp. Aid 63-2, March 1956. (Processed.)

"Selection of Stain Removers Safe for Fabrics." Corresp. Aid 63-3, April 1956. (Processed.)

"Plastics and Moth Preventives." Corresp. Aid 63-5, June 1956. (Processed.)

B. Proposals for Committee Consideration
(Order of Listing has no Priority Significance)

H. Launderability of Present-day Fabrics -- Expand research to evaluate the effect of various cleaning procedures on the properties of currently available fabrics as a basis for recommending acceptable methods for home laundering.

Included should be fabrics of different composition, blends, constructions (weight, weave, yarn combination, finish and fiber content), woven, dyed and finished according to specifications, as well as a wide range of commercially available fabrics, and various laundry conditions (time, temperature, and washing agents). This research would be carried out cooperatively with household equipment research workers. (1/13 - 1955)

I. Home Applied Finishes for Fabrics -- Initiate research on home applied finishes such as starches, plastic finishes, softeners, soil retardants, and antistatics, for improving the appearance, hand, comfort, and ease of care of clothing and household textiles.

The fabrics should be evaluated after the application of the finishes for such properties as chemical degradation, resistance to abrasion, strength, hand, drape, wrinkle resistance, and soiling. Since all finishes may affect ease of soiling and soil removal, this phase of the problem should be given special attention and should include a fundamental study of the way soil is attached to and removed from fabrics. (4/15)

J. Prevention and Removal of Discoloration of Fabrics in Use -- Expand research to determine the cause, and methods for prevention, of discoloration that occurs in fabrics manufactured from cotton and man-made fibers.

The discoloring effects of wear, laundering, drying, ironing, and storage should be investigated to determine chemical changes in the fibers, in natural soil, and in substances used in the laundering process. Among these substances are fabric softeners, brighteners, and antistatic chemicals. This research would be carried out in cooperation with household equipment research staff. (See also related proposal F following I -- Selection, Care and Use of Household Equipment in Housing and Household Equipment Section.) /New/

HOUSING AND HOUSEHOLD EQUIPMENT

I. SELECTION, CARE AND USE OF HOUSEHOLD EQUIPMENT

A. Progress on Work Under Way

1. Automatic Clothes Dryers CH

Effects of different drying methods on color and dimensional stability, strength and appearance of white and dyed fabrics have been determined in a study of operating characteristics of automatic clothes dryers. A manuscript reporting the technical findings is in preparation. Operating costs, economy of time of operator and factors affecting efficiency of automatic dryers are included in the report.

In general, it was found that drying fabrics in automatic dryers or on an indoor rack caused less loss of strength and less chemical damage than line-drying outside. White fabrics dried outdoors were usually less yellowed than those dried in automatic dryers. Certain blue-dyed fabrics changed in color more when dried in gas dryers than when dried in the sun, while certain red-dyed fabrics faded more when dried outside than when dried in a dryer heated by gas or electricity.

Plans: Funds and staff have been shifted to a new project on laundering methods for present day fabrics. Dryer effects will be investigated as they enter into this and future laundering projects. (See proposal E following this section.)

2. Bleaching Methods with Modern Equipment CH

Experimental work has been completed on the effectiveness of powdered sodium perborate bleach used under varying conditions when laundering naturally soiled white clothing and household textiles in modern household equipment. Among the conditions studied were concentration of bleach and temperature of the wash solution, application of bleach in solution of neutral soap or built synthetic detergent, length of time and frequency of application of bleach, and four drying methods--outside lines, indoor rack, and in gas and electric dryers.

Results show that after 30 launderings those fabrics washed with sodium perborate had not yellowed as much as those laundered without the bleach and were not significantly different in loss of strength. Analyses of data on other conditions studied have not been completed.

Plans: Analyses of data will be completed and a technical report prepared. Funds and laboratory staff are being shifted to a new project on laundering methods for present-day fabrics.

3. Laundering Procedures for Present-day Fabrics CH

The object of this project is to study the effects of different laundering procedures, utilizing modern equipment, on the appearance of clothing made from present-day fabrics. The findings will be bases for recommending satisfactory methods for laundering which will require a minimum of time and human energy in the care of clothing made of these fabrics.

Bolts of cloth of Dacron, Orlon, nylon, Arnel, and cotton of pure fibers and blends, have been obtained from manufacturers. Preparation of these fabrics for the first phase of laboratory research is under way. For the second phase, garments will be made of fabrics selected from the original lot to supply naturally soiled loads for checking the laundering procedures developed.

Plans: Work will be continued at a somewhat expanded level as staff time becomes available from the research on dryers and bleaching procedures.

Publications

"Cost of Electricity and Liquefied Petroleum for Cooking, Refrigerating and Water Heating." E. C. McCracken and E. Beveridge. Agri. Inf. Bul. 141. Aug. 1955.

"Home Freezers, Their Selection and Use." E. C. McCracken. Home and Garden Bul. 48. Feb. 1956 (Rev.).

"Washing Machines, Selection and Use," E. S. Ross, K. Taube, and D. S. Greene. Home and Garden Bul. 32. Aug. 1955.

B. Proposals for Committee Consideration
(Order of Listing has no Priority Significance)

A. Performance Requirements of Hand Irons -- Initiate research to determine satisfactory ironing temperatures and to develop laboratory methods for predicting the performance-in-use of hand irons.

With the rapid development of man-made fibers and of new finishes for cotton and wool, equipment manufacturers are asking for information on the effect of temperature on physical and chemical properties of these materials as a basis for establishing recommended ironing temperatures and designing hand iron thermostats. (1/10)

B. Automatic Temperature Controlled Surface Unit -- Initiate research to determine operating characteristics and performance requirements of thermostatically controlled surface units and burners as a basis for recommending satisfactory procedures for their use.

Since thermostatically controlled surface units operate to control the temperature of the pan by a temperature-sensitive element in the center of the unit or burner which makes contact with the pan bottom, research is needed to determine the performance of these controls when using pans of different materials and design. This information on operating characteristics along with a standardization of dial markings is needed by home economists in recommending temperatures for utensils of different materials. (2/10)

C. Electronic Range Cooking -- Initiate study of performance-in-use of the household electronic range.

With the emergence of radiation cooking from the theoretical and laboratory phase into limited commercial production, research is necessary to determine the variation in energy input during cooking processes and during and after protracted periods of use; the effect of variation in input on energy utilization; the effect of kind, mass, size, and location of cooking load on the temperature distribution in the food during and after the period of energy input. Problems involved in home maintenance of adequate performance should also be investigated.(4/10)

D. Air Conditioning in the Home -- Initiate exploratory research on the environmental conditions resulting from air conditioning in homes and their effect upon various aspects of family living and household management. (6/10)

E. Effectiveness of Cold Water Rinsing -- Initiate research to determine whether cold water is as effective as warm rinsing of detergent solutions from fabrics during the laundering process.

Limited research indicated that a cold water rinse was effective with clean swatches. Further research is needed, using naturally soiled fabrics, before use of a cold water rinse can be recommended. If satisfactory, the cold water rinse cycle would cut down the expense of heating water for rinsing and allow for other important uses of the hot water supply. (7/10)

F. Laundering Procedures to Reduce Discoloration -- Expand research on use of modern laundering equipment to determine procedures which will remove the constituents of soil that cause discoloration in naturally soiled fabrics from cotton and man-made fibers.

Since recent research has shown that some naturally soiled cotton garments and household textiles had discolored after being washed and dried in modern equipment, further equipment studies are needed. These would be closely coordinated with proposed chemical studies of the textiles themselves and of the nature of the soiling effect. (See also related proposal J following III, FABRIC CARE in TEXTILES AND CLOTHING section) /New/

II. HUMAN ENERGY EXPENDITURES FOR HOUSEWORK

A. Progress on Work Under Way

As one basis for designing equipment, rooms, and work spaces, and for determining work procedures which will conserve the energy of normal and handicapped homemakers, research has been focused on calories expended by women in specific work situations. CH

Studies have been completed on the energy cost of using built-in ovens at different elevations. The six women who served as subjects were of average height and basal metabolic rate. They ranged in weight from about 110 to 160 pounds and in age from about 20 to 55 years. Oven rack heights ranged from 16 to 44 inches from the floor. There was no statistical difference attributable to the height of the rack in the energy expended for racks at 28, 32, 36, and 40 inches, the calories being .402, .386, .369, and .383 respectively. There was a significant difference between energy expended in lifting the load and placing it down at the 24-inch level, .442 calories, as compared to energy for the 28-inch level; also, in lifting it up to the 44 inch level, .411 calories, as compared to the 40-inch height. The type of oven (gas or electric), or of door (drop or swinging), had no significant effect on the results.

On the basis of these findings, recommendations have been developed for the height of the bottom of the interior of typical electric and gas ovens in order to insure that the racks in ovens and broilers will be within the energy-saving heights of 28 to 40 inches from the floor. These practical recommendations, and the basic data cited above were published in the "Stove and Appliance Builder" and have received widespread attention.

Laboratory work has been completed, and a partial analysis of the results has been made, on energy requirements for storing utensils in different locations and under various conditions. A manuscript is being prepared covering this phase of the project.

Plans: Plans are being developed for a laboratory study of the effect of ambient temperature on the energy expenditure of homemakers, and work along these lines will continue at the same level. Analysis of the findings of the phases completed to date in which change in body posture is the main variable, will be prepared for publication.

Publications

"Human Energy Expended in Using Built-in Ovens at Different Elevations." E. C. McCracken and M. Richardson. Stove and Appl. Builder. 21 (2): 36-39. Feb. 1956.

B. Proposals for Committee Consideration

None.

III. FUNCTIONAL REQUIREMENTS AND DESIGNS FOR FARM HOUSES

A. Progress on Work Under Way

Work in this area contributes to the coordinated program of research in rural housing carried on by CH and AE and the State Agricultural Experiment Stations in the four regions.

1. Energy-saving Kitchen Designs CH

One kitchen design in which circular floor-to-ceiling revolving cupboards were utilized for the storage of supplies was tested in three arrangements. In a broken U arrangementt the average distance walked by the homemaker per meal during the preparation of nine different meals was 300 feet; for the U and parallel-wall arrangements it was 289 and 278 feet, respectively. This indicated that, considering only the kitchen itself, no one arrangement was outstandingly better than another and that the relationship of the kitchen to the rest of the house, particularly the location of back entry and dining room doors, would be an important consideration when selecting the most efficient and convenient arrangement for a particular house. After extensive use of the 3-kitchen arrangements, modifications were made as needed to improve the design of storage cabinets. The broken-U arrangement, which permits easy and step-saving access to the rest of the house was built in finished form and installed in a combination kitchen-workroom.

In addition to the meal preparation and dining areas, this room includes space for laundry and home business centers and for storage of frozen and canned food supplies. Results of recent research on energy costs and space needs for housework were incorporated throughout. During the first week after it was completed, the room was displayed to approximately 1,000 persons, including educators, Extension workers and research leaders from all parts of the United States and several foreign countries, most of them attending the annual meeting of the American Home Economics Association. A farm magazine and also a magazine published for handicapped persons obtained picture stories, and mnny newspapers have carried feature articles on the design. A radio recording has been made and plans are under way for the preparation of a popular leaflet, a color film strip and television film publicizing the features of this kitchen development. Working drawings are being prepared and will be distributed through the Regional Plan Exchange Services.

Work is under way on the second in the series of kitchens for physically handicapped homemakers in which storage for supplies will be provided by stationary floor-to-ceiling cabinets.

Plans: Work on the second kitchen design will be expanded as staff time becomes available from the space requirements studies. New work will include a study of design of kitchen sinks and their placement in relation to various kitchen tasks requiring water. A third kitchen design utilizing conventional well-hung storage facilities will be tested, and technical findings will be prepared for publication.

2. Farmhouse Plans for the Regional Plan Exchange Service CH

Working drawings and an illustrative catalog have been completed for the farmhouse plans selected for inclusion in the Southern Plan Exchange Service. The catalog will be published this fiscal year and its cost will be borne by the Federal Extension Service. Revision of the Western Plan Service catalog is in progress, the USDA was requested to assist in development of new plans and the revision of existing plans.

Plans: Efforts are being made to fill vacancies on the architectural staff so that work can continue at the same level.

3. Space Requirements for Home Sewing Activities CH

Research conducted at the Pennsylvania State University in cooperation with CH, has established the dimensions of space needed for home sewing. Measurements of the angle of torso bend, and subject's comments concerning muscle strain and discomfort, were used as the basis for establishing the table height at which each subject could work best when laying a pattern and cutting out a garment. Optimum working heights for individuals ranged from 34 to 40 inches, the variation apparently due to differences in subjects' statures and arm lengths. Further research showed that for cutting tables non-adjustable to the individual user's needs, a height of 36 inches generally was comfortable for both tall and short women.

An analysis was made of the amount of walking, stretching, and handling of material and pattern by five subjects when laying out and cutting four different patterns from four fabrics on tables of four sizes. Results showed that the minimum feasible length for the cutting table was 56 inches; 72 inches was adequate, while 108 inches was the maximum feasible. A width as narrow as 28 inches was usable, but there was a saving in time and effort and the quality of work was better on a table 36 inches wide. This width was found to be the maximum if the table was enclosed on one long side; if free-standing, the cutting table can be as wide as 60 inches.

The seat height of the chair used for sit-down sewing tasks was determined on the basis of anatomical measurements and of the subjects' rating of the degree of comfort afforded by chair seats of various heights. Each of the 24 subjects was most comfortable, tired least readily, and maintained best posture while sewing when the chair seat was 0.5 to 1.5 inches lower than the vertical distance from the floor to the under-knee. The seat heights selected by individuals for their own needs ranged from 14 to 17.5 inches; the median was 16 inches, the standard deviation, 0.8 inch. Chairs of the median height were used in subsequent phases of the work in which dimensions were established for other sewing equipment used from the seated position. Specifications for these pieces of equipment have been developed.

Five arrangements of the equipment were used in the actual construction of a garment after it was cut out. It was found that the flow of work was smoother and the quality of work was better in a U-shaped arrangement with sewing machine in the center, ironing board (lowered to sitting height) at the left, and auxiliary work space, also at sitting height, at the right. Left-handed workers might prefer this placement reversed.

Plans: The work described above has been completed and a manuscript reporting the findings of this study is being prepared by Pennsylvania State University for publication as a contribution to the Northeastern Regional Housing Research program.

4. Space Requirements Around Household Equipment and Furniture CH

Dimensions of space needed around household equipment and furniture for their effective use and care are being determined in a cooperative project between CH and the Illinois, Pennsylvania Alabama, and Washington State Agricultural Experiment Stations. At the Beltsville Laboratories, the anthropometric measurements necessary for these dimensions were selected and methods were developed and standardized for measurements not hitherto established. In cooperation with Illinois Experiment Station, a manual of procedures was prepared and distributed to the five agencies participating in the study. Included in the manual /entitled "Manual of Measurements. CH-2(W-2) and issued Feb. 1956/ are descriptions and specifications for furniture and measuring equipment; the experimental design; instructions for selecting and scheduling worker-subjects; descriptions and explicit instructions for the 28 anatomic, 12 basic-activity, and 36 household-activity measurements that are to be obtained, and sample forms for recording data. Laboratory research now under way is being directed toward obtaining these measurements on a sample of 50 subjects.

Plans: Measurements will be completed and analysis of data from the five participating laboratories will be initiated. This work will be maintained at the same level during the coming year.

5. Space Requirements for Home Food Preservation CH

The regional farm housing surveys made in 1948 showed that over 90 percent of farm families preserve food at home. Data on quantity of food preserved indicated that it was highly important that adequate space, efficiently arranged, be provided in farmhouses for this activity. A technical bulletin reporting the research on space requirements for home food preservation makes available for the first time information on dimensions needed in designing farm kitchens and workrooms for use as food preservation areas. Dimensions given for straightline, L-shaped, and divided counters of 2 depths, for 1 and 2 workers, and in various relationships torange and sink provide data needed in any design problem. Storage space requirements for canned foods and empty jars are included.

Plans: This work has been completed. Staff and funds have been shifted to the study of energy-saving kitchen designs.

6. Storage Space Requirements for Household Textiles and Clothing CH

Two reports of a study of storage space requirements for household textiles have been issued. A technical report for research workers gives in detail the findings on dimensions of space needed for quantities of linens stored by farm families, as reported in the 1948 farm housing surveys, and for individual articles of household textiles. Using the latter, storage spaces dimensions can be computed for any quantity and combination of kinds of linens owned. The unit space dimensions also serve as basic data for recomputing storage space requirements for farm families if subsequent surveys show changes in the pattern of kinds and quantities of linens stored. Design data for 10 of the storage units dimensioned to accommodate farm families' supplies of household textiles were selected for graphic presentation in a semi-technical bulletin for architects and others designing storage spaces.

Plans: Analyses will be completed and data on requirements for clothing storage will be prepared for publication. Laboratory staff has been shifted to the study of space requirements around household equipment and furniture.

Publications:

CH

"Space Requirements for Home Food Preservation." M. S. Howard and G. K. Tayloe. Tech. Bul. 1143. April 1956

"Storage Space Requirements for Household Textiles." A. M. Woolrich, M. M. White, and M. A. Richards. ARS 62-2. Sept. 1955. (Processed)

"Storage Units for Household Linens . . . Design Data for Farmhouse Planning." A. M. Woolrich and J. D. Herrington.

"The Beltsville Energy-Saving Kitchen." Corresp. Aid 63-6. June 1956. (Processed)

B. Proposals for Committee Consideration
(Order of Listing has no Priority Significance)

G. Farm Household Water Requirements -- Initiate research to determine total volume and peak water requirements for the farm household to provide information needed for recommendations regarding water supply, plumbing systems, and waste disposal facilities.

Because the water supply is short in many rural areas and is becoming critical in some places, water requirements of household activities and of different types of water-connected household equipment should be determined under conditions of home use as a basis for planning the type and number of pieces of equipment that can be operated on the available water supply. Total water requirements and peak load of farm homes should also be determined as a basis for recommendations for size of pump, storage tank, water heater, septic tank, and drain field, and to help farmers in determining the adequacy of new wells. The information would also serve in planning water conservation.

This research would furnish additional essential information not provided by studies being made by agricultural engineers on farm water supply, sewage disposal and farm plumbing. (3/10)

H. Functional House Plans -- Expand work on development and evaluation of functional farm house plans incorporating results of the recent State-Federal coordinated housing research program

These results include space requirements for various household activities, efficient arrangements for installed equipment and built-in facilities, designs for functional storage facilities, and families' preferences for location of activities and certain housing features. With farm families now spending approximately one billion dollars per year in remodeling and building new homes, the present Regional Plan Service work should be accelerated so that a wide variety of plans are available at an early date (5/10)

I. Materials and Finishes for Walls, Table Tops and Floor Coverings for Kitchens and Workrooms -- Initiate research to make available comprehensive information on performance of different types of materials for wall, work counter and floor coverings for kitchens, workrooms and bathrooms.

Particular attention should be given to recently developed types of coverings in relation to different uses, ease of installation, care, maintenance and durability. Existing data would be summarized and evaluated as a first step in such an investigation.(8/10)

J. Lighting Requirements for Household Activities -- Initiate analytical work on lighting requirements as a basis for a reference source of home lighting needs.

Information available from industrial, military, public health and other organizations should be compiled and examined in terms of its validity and applicability to home use. Such an analysis would pin-point the areas in which research is needed on quantity and quality of light for various activities performed in present-day home. Those segments where data are adequate would provide information needed to assist families in planning their home lighting and in selecting lighting fixtures and lamps. (New)

FOOD AND NUTRITION

I. FOOD COMPOSITION IN RELATION TO NUTRITIVE VALUE

A. Progress on Work Under Way

1. Amino Acids in Bread HN

In laboratory assays to obtain data on amino acids in a variety of foods, wheat and bread at its various stages of production have been investigated intensively. The bread samples analyzed were baked from a "national" sample of wheat using a standard formula in the test laboratories of the Grain Branch of AMS, and replicated the second year. The wheat and fractions of wheat, the flour and other ingredients were analyzed separately, and the combined ingredients were analyzed in the dough unfermented, dough fermented, and in the bread after baking. Recombination of values for wheat fractions vs. whole wheat, and of bread ingredients vs. fresh dough proved to be excellent checks on validity of analytical procedures. Slight to moderate losses in amino acids were traced to baking per se, none to the dough processing. In both series of experiments, losses of around 20 percent were found for lysine and tyrosine; and around 10 percent for leucine, methionine, and phenylanlanine. For all other amino acids, the losses were slight or negligible, but only one set of values in 22 did not show some measure of loss.

Plans: Work completed and a technical paper prepared for publication.

2. Accessory Amino Acids HN

In addition to assaying some 40 foods for ten "essential" amino acids, and for cystine and tyrosine, their content of aspartic acid, glutamic acid, glycine and proline, have been determined. Values will be sought for alanine and serine in the same foods to complete the information on the so-called "nonessential" amino acids; some of these are recognized to have accessory values in nutrition.

Plans: The analyses are planned for completion in 1957; reports of analytical data and methodology will be prepared for publication.

3. Proximate Composition of Foods HN

For some time questions have been raised in connection with diet appraisal about the probable validity of applying available food composition and energy value data to present day foods. To help supply current information, all food samples used for any laboratory purpose are being analyzed to determine proximate composition. Analyses have now been completed in 168 samples from pantothenic acid assays, and on a variety of foods used in other experiments, with particular attention to meats. The need for extending such analyses to a wide variety of pork products is indicated by the

two-fold differences in fat content found in several analyses of roast pork, prepared from different brands and market samples. The fat content of pork as purchased tended to be higher than in current food composition tables, while all sausages analyzed were higher in fat than is shown in current tables.

Plans: Intensive investigations on proximate composition of livestock products have been made possible through increased appropriations for such work. Amino acids, minerals and 6 B-vitamins will be determined on selected samples from animals differing in age and feed management. Work will be initiated on lamb and pork, for which data are known to be inadequate, and on differences related to market quality and to lean as compared with fat types.

4. Minerals in Foods HN

During the year market samples of 10 vegetables -- beet, cabbage, carrot, celery, kale, lettuce, onion, snapbean, spinach and tomato -- have been assayed for nine mineral elements -- calcium, phosphorus, magnesium, sodium, potassium, iron, copper, maganese and aluminium -- in connection with standardization of analytical procedures. The analysis will now be extended to a wider geographic sampling of these and other vegetables, to determine whether mineral composition differs much from that reported for foods analyzed 50 years or more ago. In these ten samples of vegetables, iron and calcium values were lower than the older data except lettuce and kale which tended to be higher, but values for phosphorus, magnesium and sodium deviate variously. No conclusions can be drawn until data are available from a wider sampling of these vegetables.

Plans: To be continued at about the same level.

5. Progress in Analytical Methods for Food Assays HN

During the year, considerable progress has been made in developing, improving, or standardizing several analytical procedures.

(a) Vitamin B_6. In the vitamin B6 assays, chromatographic separation of the components of the vitamin combined with a microbiological assay, using a yeast as the response organism, has been developed into a standardized procedure. Extraction of some food samples using a 15 minute autoclaving plus an enzyme treatment, gave results comparable to the customary five-hour autoclaving.

(b) Vitamin B_{12}. Work has proceeded on standardization of procedures to insure reproducibility and accuracy. In assay of a few foods, comparable data have been obtained using either of two types of organisms, a protozoa and a lactobacillus. The protozoa is reported to have specific requirement for vitamin B_{12}, while the lactobacillus may utilize related

compounds including the pseudo-vitamin. Both organisms will be used in analysis of typical foods in early work, and throughout all assays if inconsistent findings justify this type of replication. Bioassays will be used for further validation of the method.

(c) Fat. Improved procedures for extraction of fat from foods high in carbohydrate will make possible more precise values on fat content of foods. From acid-hydrolyzed samples, unrealistically high values had been obtained for fat, due to either extraction of furfural derivatives and sugars.

(d) Crude Fiber. An improved enzyme method for determination of crude fiber has been standardized with respect to pretreatment of samples containing starches, and to conditions of time, temperatures, and concentration for enzyme solumbilization of the starches. Some improvements in the method of correcting for residual protein are being sought before application of assay to a variety of foods.

Plans: Work along these lines will be continued at about the same level.

Publication HN

"A Microbiological Method for Determination of Cystine in Foods," M. J. Horn and A. E. Blum, Cereal Chem. 33 (1): 18-28, Jan. 1956.

"Cystine, Tyrosine and Essential Amino Acid Contents of Selected Foods," C. H. Edwards, L. P. Carter, and C. E. Outland, Agr. and Food Chem. 3 (11): 952-957. Nov. 1955. (Contract with Carver Foundation and Tuskegee Inst.)

"Pantothenic Acid in Foods." E. G. Zook, M. M. Mac Arthur, and E. W. Toepfer. Agr. Handbook 97 (in press). /Contract with Minnesota/

"Boneless Beef: Raw, Cooked, Served . . . Results of Analysis for Moisture, Protein, Fat and Ash." E. W. Toepfer, C. S. Pritchett, and E. M. Hewston, Tech. Bull. 1137. Dec. 1955.

"The Use of Pandanus Fruit as Food in Micronesia," C. D. Miller, M. Murai and F. Pen. Pacific Sci., 10 (1): 3-16. Jan. 1956. (Contract with Hawaii)

"Fatty Acid Composition, and Oxidative Deterioration During Storage of Fats in Cuts of Beef, Lamb, Pork, and Turkey," O. S. Privett, F. J. Pusch, and W. O. Lundberg, Food Technol. 9 (7) 347-351, July 1955.

B. Proposals for Committee Consideration
(Order of Listing has no Priority Significance)

A. Carbohydrates in Foods -- Initiate laboratory analyses on carbohydrates in foods to replace inadequate or obsolete data likely to give erroneous results in diet planning and appraisal.

Present tables of food composition carry values for carbohydrate by difference between total and other constitutents of proximate composition--protein, fat, moisture, and ash. Values from direct assays have not been feasible because of inadequate analytical methods. For some time clinicians, including those responsible for diets of diabetics and obese persons, have wanted better values as a basis for diet control. General nutrition interest in the kind and amount of carbohydrates in foods is increasing also because of their interrelationship with other nutrients, including amino acids. Work should be initiated to determine systematically the quantities of different forms of carbohydrats--sugars, starches, cellulose, and pentosans--in common foods, in order that the values may be available for use in the current revision of tables of food composition. (6/16)

B. Organic Acids in Foods -- Initiate laboratory analyses to determine the kinds and quantities of various organic acids in fruits and vegetables.

Present tables of food composition treat all organic acids as carbohydrates in reckoning caloric values, but some are not metabolized for energy production and some affect the utilization of calcium and other nutrients. Data on the quantitative distribution of the predominating organic acids in foods are needed to improve the accuracy of values for calories and other nutrients, and to provide clinicians with basic information needed in prescribing diets for some metabolic disorders. (This work cannot be completed in time for the current revision of food composition tables.) (16/16)

C. Fatty Acids and Other Lipids in Foods -- Expand research to obtain more comprehensive data on fatty acids and other lipid fractions in foods.

Compilations of data available in the literature and results from recent contract research leave much to be desired in figures for estimating the content of "essential" fatty acids in foods, and afford very little or no information on the other fatty acids or the other lipid fractions. Information on composition of fats is inadequate for a reasonable appraisal of the lipid value of foods, or for interpreting many research findings on the biological complete characterization of the lipid constituents of foods, including the long and short chain as well as the saturated and unsaturated fatty acids, and also cholesterol, phospholipids and other lipids of nutritional importance. Data are needed on the variations in fatty

acid content of fats of animal origins, particularly those associated with common differences in animal ration. Analytical techniques should be improved and more rapid assay methods developed to facilitate accumulation of data keeping pace with research advances in understanding the role of fats in nutrition. (New)

D. Nutritive Value of Poultry Products -- Expand research to provide improved data on the nutritive value of poultry in forms as commonly processed for the table.

Poultry is being produced by various new growth-acceleration methods, is being processed differently for the market, and is being sold in a wider variety of cooked products than ever before. Present data on nutritive value are inadequate, and basic information on size of birds and yields of meat from the whole or different parts of birds are not available for adapting such data as are available. New data should include edible yield calorie, protein and B-vitamin values, of poultry products as marketed and as eaten. In view of the increasing consumption of poultry products, analyses should be undertaken to obtain representative figures on the nutritive value of entire carcasses and for component parts, for principal kinds, age classes of birds as marketed, raw and ready-to-serve in commonly processed forms. (New.)

II. HUMAN NUTRITION

A. PROGRESS ON WORK UNDER WAY

1. Diet and Physical Impairment HN

The long-term study of the relation of diet to premature physical impairment in laboratory animals has resolved itself into problems of balance among nutrients, and data are being summarized for publication. Data to be included in the publication include (a) analytical data for proximate composition, and computed data for amino acids, fatty acids, minerals and the known vitamins for the diets used; (b) biochemical data including blood cholesterol, electrophoretic analyses and composition of liver and kidneys; (c) physical data on feed consumption, size of animals and survival periods; and (d) autopsy data on size and other gross changes and histological conditions of organs.

Plans: To publish findings, as indicated above.

2. Factors Affecting Requirements for Amino Acids HN

Experimental research using laboratory animals is indicating that a number of factors may affect the requirements for amino acids. The amounts and kinds of other nutrients in the diet may determine whether the calories eaten are converted to lean tissues or to fat depots in various parts of the body. Last year it was reported that with restricted protein intake, diets containing the starches of corn, rice, or wheat, tend to lessen the amount of liver fat, deposited, as compared to a diet containing sucrose as the sole carbohydrate. Threonine has been found to be more effective than any other amino acid or carbohydrate tested in preventing the accumulation of liver fat under these conditions. More carcass fat, but the same protein content, resulted when penicillin was fed in the presence of corn starch than when fed with sugar. These studies are showing that data on weight gains and from nitrogen balances must be accompanied by data on tissue or carcass composition for sound interpretations of research results.

Plans: This work is being redirected to use intact food protein in place of amino acid formulas.

3. Availability of Nutrients from Foods HN

Considerable progress has been made through contract research toward developing an improved method for measuring the nutritional availablility of energy value, protein, and amino acids in foods. This research, using human subjects, indicates that analyses of feces and urine for nutrients in addition to the usual nitrogen, fat and carbohydrate determinations are needed for evaluation of data on digestibility of foods as obtained by classical procedures, and in order to help explain conflicts in published data on biological values of proteins.

Plans: The findings will be prepared for publication.

4. Fatty Acid Requirements HN

Continued investigations of requirements for unsaturated fatty acids by children have indicated that changes in blood serum levels of unsaturated fatty acids are related to the form in which linoleic acid is given, as well as to the intake level. When added to a diet low in fat, changes of comparable magnitude in blood levels were obtained from supplementing with 1 percent of the calories as triglyceride (trilinolein) or with 3 percent of the calories in the form of the methylester of linoleic acid.

Plans: These investigations will continue at about the same level until the contract work is completed.

5. Metabolic Response of Young Women to a Reference Diet HN

Contract research at four locations is determining individual variability of young women in their response to a reference diet containing moderate levels of nutrients, under uniform conditions of dietary components (same supply lot), management of feeding and collections, and analytical methods. All stations are measuring the response to the reference diet without change for 15 days, followed at two locations, north and south, by variation in levels of magnesium intake, and at one location by variation in levels of pantothenic acid intake. Analyses will include nitrogen, fat and minerals to show intake-excretion balances, and urinary excretion of vitamins in relation to intake. Data will be available on 24 subjects, within limited ranges of age and height.

Plans: Laboratory work at these locations will probably be completed during the year.

6. Metabolic Patterns of 7-9 Year Old Girls HN

Analyses have been completed, and data summarized on one phase of the Southern Region cooperative investigation of the metabolic response of preadolescent girls to a diet of commonly served foods, supplying nutrients at approximately the levels suggested by the National Research Council. These data (obtained from 11 girls at the Louisiana and Tennessee stations) will be combined for publication with data resulting from the second phase -- this year's study of 12 girls at the Virginia station. The Human Nutrition Research Branch has been responsible for staff assistance during the actual feeding periods, and for carrying out the analyses of fat in food and fecal samples, of folic and pantothenic acid in food and urine, and of analyses (through contract) of tryptophan and niacin derivatives in urine. Experience gained in the management and methodology of this study will make a considerable contribution to research in human metabolism.

Plans: Analyses will be completed and reports prepared for publication.

7. Basal Metabolic Rates in Children HN

Basal metabolic data on 388 children, mostly 9-11 years of age, obtained over a period of years, are being analyzed and prepared for publication. During the year, these data have been augmented by unpublished data on 380 children 12-14 years old, measured at the University of Arizona; on 250 children 15-16 years old, measured at the State College of Washington; and on 127 children 2-15 years old measured at the University of Colorado School of Medicine, Denver. This compilation will provide needed reference data for many types of nutrition research.

Plans: The data will be prepared for publication.

8. Heights and Weights of U. S. Population Groups HN

During the year, a small edition of the preliminary tabulations of original data on heights and eights of U. S. children since 1920 was issued for clearance with contributors. As a result, considerable additional data have been made available, particularly for late adolescence. The summarization is now being extended to include among others the following data on adults: a geographic summary of the height and weight data reported in the food consumption survey of 6,000 families made by USDA in 1955; unpublished data on more than 150,000 students collected in 1950 by colleges and universities; and data from recent regional cooperative studies of nutritional status of older persons in States of the North Central and Western Regions. Cooperation in supplying the many data has been most encouraging. Although the summary was intended primarily for reference by nutrition investigators, many scientific groups are showing interest in the material.

Plans: The analyses will be completed and data prepared for publication.

Publications: HN

Nutritional Requirements

"The Quantitative Amino Acid Requirements of Young Women. I. Threonine." R. M. Leverton, M. R. Gram, M. Chaloupka, E. Brodovsky and A. Mitchell. Jour. Nutr. 58, (1): 59-81. Jan. 1956. (Contract with Nebraska.)

"The Quantitative Amino Acid Requirements of Young Women. II Valine." R. M. Leverton, M. R. Gram, E. Brodovsky, M. Chaloupka, A. Mitchell, and N. Johnson. Jour. Nutr. 58, (1): 83-93. Jan. 1956. (Contract with Nebraska.)

"The Quantitative Amino Acid Requirements of Young Women. III. Tryptophan." R. M. Leverton, N. Johnson, J. Pazur, and J. Ellison. Jour. Nutr. 58 (2): 219-299. Feb. 1956. (Contract with Nebraska.)

"The Quantitative Amino Acid Requirements of Young Women. IV. Phenylalanine - With and Without Tyrosine." R. M. Leverton, N. Johnson, J. Ellison, D. Geschwender and F. Schmidt. Jour. Nutr. 58 (3): 341-353. Mar. 1956. (Contract with Nebraska.)

"The Quantitative Amino Acid Requirements of Young Women. V. Leucine." R. M. Leverton, J. Ellison, N. Johnson, J. Pazur, F. Schmidt and D. Geschwender. Jour. Nutr. 58 (3): 355-365, Mar. 1956. (Contract with Nebraska.)

"Amino Acid Requirements of Young Women Based on Nitrogen Balance Data. I. The Sulphur-Containing Amino Acids." M. E. Swendseid, I. Williams and M. S. Dunn. Jour. Nutr. 58 (4): 493-505. Apr. 1956. (Contract with California.)

"Amino Acid Requirements of Young Women Based on Nitrogen Balance Data. II. Studies on Isoleucine and on Minimum Amounts of the Eight Essential Amino Acids Fed Simultaneously." M. E. Swendseid, and M. S. Dunn. Jour. Nutr. 58 (4): 507-517. April 1956. (Contract with California.)

"A Standardized Diet for Metabolic Studies--Its Development and Application." F. L. Meyer, M. L. Brown, H. J. Wright, and M. L. Hathaway. Tech. Bul. 1126, 81 pp., Nov. 1955.

"Starches, Sugars and Related Factors Affecting Liver Fat and Nitrogen Balances in Adult Rats Fed Low Levels of Amino Acids." M. Womack and M. W. Marshall. Jour. Nutr. 57 (2): 193-202. Oct. 1955. (Contract with Texas.)

"Fat in Diet of Infants in Relation to Caloric Consumption, Growth, and Serum Levels for Specific Fatty Acies." A. E. Hansen, H. F. Wiese, M. Lawlis, D. J. D. Adam, A. Goldman, and M. Baughan Amer. Jour. Diseases of Children 90 (5): 621-622. Nov. 1955. (Contract with Texas.)

"Effect of Intake of Linoleic Acid on Unsaturated Fatty Acids of Serum of Infants." (Abstract) H. F. Wiese, A. E. Hansen, D. J. D. Adam, and M. A. Baughan. Fed. Proc. 15 (1,pt.1): 577. Mar. 1956. (Contract with Texas.)

Food and Nutritional Status Studies

Cooperative With Western Region

"Cooperative Nutritional Status Studies in the Western Region. I. Nutrient Intake." E. B. Wilcox, H. L. Gillum, and M. M. Hard. West. Region. Bul. 383, 44 pp., illus. 1956.

"The San Mateo Study of the Nutritional Status of the Aging." A. F. Morgan. California's Health 13 (9): 65-72. 1955. (California.)

"Nutritional Status of Adolescent Idaho Children. II. Food Habits." K. P. Warwick, S. W. Bring and E. Woods. Amer. Diet. Assoc. Jour. 31 (11): 1143-1146. Nov. 1955.

"Nutritional Status of School Children 15 and 16 years of Age in Three Idaho Communities; Blood Biochemical Tests." S. W. Bring, K. P. Warwick, and E. Woods. Jour. Nutr. 57 (1): 29-45. Sept. 1955.

"Dietary Studies of Montana 15 year Olds and Montana College Freshmen." L. M. Odland, L. Page, and L. Guild. Montana Agr. Expt. Sta. Bul. No. 518, April 1956.

"Dental Studies with Montana College Freshmen and Adolescents." L. M. Odland, Bul. of Amer. Assoc. of Public Health Dentists 16 (1): 6-8. Feb.1956.

"Nutrient Intakes and Food Habits of Montana Students." L. M. Odland, L. Page and L. P. Guild. Amer. Diet. Assoc. Jour. 31 (11): 1134-1142, Nov. 1955.

"Dental Caries Experience of Montana Students." L. M. Odland, L. Page, and S. T. Dohrman. Amer. Diet. Assoc. Jour. 31 (12): 1218-1222. Dec. 1955.

"Bone Density Relationships in Adolescence." (Abstract) L. M. Odland, Fed. Proc. 15 (1, pt. 1): 567. Mar. 1956. (Paper presented at Amer. Inst. of Nutr., April 1956.)

"Nutritional Status of Selected Adolescent Children. I. Description of Subjects and Dietary Findings." M. M. Hard and N. C. Esselbaugh. Amer. Jour. of Clin. Nutr. 4 (3): 261-268. May-June 1956. (Washington.)

Cooperative With North Central Region

"Food Intake and Body Weight of Older Women." P. Swanson, H. Roberts, E. Willis, and others. Proc. of the Weight Control Colloquium 80-96. 1955. (Iowa.)

"The Right Foods . . . Your Passport to Good Health." P. Swanson, and E. Willis. Iowa Farm Sc. 10 (3): 17-19. Sept. 1955. (Iowa)

"Let's Reduce Sensibly." P. Swanson, and E. Willis. Iowa Farm Sc. 10 (1): 6-8. July 1955. (Iowa.

"As Women Grow Older." A Biester, E. Zeitler. Farm and Home Sc. 12 (3): 17-19. 1955. (Minn.)

"Food Habits of South Dakota Women." L. Burrill, and B. Alsup. So. Dak. Agri. Expt. Sta. Bul. 451, 24 pp., May 1955.

"Very Heavy and Obese School Children in Iowa." E. S. Eppright, I Coons, and E. Jebe. Jour. Home Econ. 48 (3): 168-172. Mar. 1956.

"Food Intake and Body Size of Iowa School Children." E. S. Eppright, V. D. Sidwell, and E. Jebe. Proc. of the Weight Control Colloquium, 119-131, 1955.

B. Proposals for Committee Consideration
(Order of Listing has no Priority Significance)

E. Fat in Nutrition -- Initiate research to investigate the role of fat in human nutrition, such as the relationship of the amount and kinds of fat to metabolism of other nutrients, determination of nutritional situations, the physiological effect of fat artifacts arising from modern food processing, and the dietary precautions needed when different types of fat in diets are unusually high or low.

This research is urgent in view of the growing evidence of the relation of the nature of dietary fat to the development of biochemical changes in blood and to renal-cardiovascular damage. Studies of aging persons and of laboratory animals on abundant diets have implicated high-fat, high-calorie diets in some disorders of metabolism. For various reasons, the average proportion of fats in U. S. diets has increased from 32 percent in 1910, to 41 percent in 1955. However, there are wide variations in the percentage of the calories from fat as well as in the types of fat in the diets of some individuals, which has been further complicated by the effects of modern food processing such as deep fat frying and hydrogenation. The problem requires more attention to compositional factors and improved methodology in all phases of the investigations. (1/15)

F. Physiological Availability of Nutrients from Foods -- Expand research to determine the physiological availability of various nutrients from different foods, and the extent to which food processing, other food constituents and diet patterns affect their availability.

This information is needed for appraising the nutritional value of various diets and for predicting the value of diets planned for specific situations. Particular attention should be given to the physiological availability of amino acids from different types of foods and from diets representing typical food habit patterns. This work calls for digestibility and metabolic studies using human subjects, and for improved techniques in the analyses for many nutrients. (2/15)

G. Factors that Affect the Food Consumption of Children -- Initiate research on children's acceptance of important kinds, forms, and combinations of food and of factors that influence their food consumption as a basis for determining how desirable food habits can be developed. (3/15)

H. Dietary Factors Affecting Amino Acid Requirements -- Expand research on the effect of type of carbohydrate in the diet on amino acid utilization to include other components of diet, and other biochemical and physical criteria of the nutritional effects.

Attention should be given to "non-essential" amino acids and non-protein nitrogen, as well as to "essential" amino acid ratios in the diet, to intact food proteins, to carbohydrates commonly found in some of the processed forms of foods as eaten, and to possible effects of kinds and amounts of fat. The criteria should include, in addition to studies of nitrogen balance and calorie utilization, analysis of blood and other tissues by histological and chemical means. This basic information is needed for determining protein and other nutrition requirements of people consuming diets of different patterns. (4/15)

I. Fatty Acid Requirements of Various Age Groups -- Initiate research to determine the requirements of various age groups for the long-chain "essential" fatty acids, with particular attention to adolescents, and to adults.

Some approximation has been made of the probable need of infants and young children for linoleic acid. Comparable information should be obtained for other age groups, particularly for adolescents, adults in the late thirties, and adults over 60 years of age. Data are needed showing the biochemical response to diets containing different amounts and caloric proportions of linoleic acid in the forms commonly found in foods, including analysis of the fatty acid content of blood, and of cholesterol, phospholipids and other suitable substances related to fat metabolism. (New)

J. Nutritional Requirements for Newer B-vitamins -- Initiate research to determine human requirements for pyridoxine, pantothenic acid, folic acid and related B-vitamins, in normal young adulta.

Research using "normal" young adults should be conducted to determine requirements under identical conditions for those B-vitamins on which data other than clinical are scarce. Consideration should be given to the types of diet pattern used, and to the proportions of other nutrients present, including the well known B-vitamins -- thiamine, riboflavin and niacin -- and the amino acids and fatty acids. (New)

III. FOOD QUALITY AND HOUSEHOLD USE

A. Progress on Work Under Way

1. Palatability of Poultry Affected by Diet HN

A series of cooperative investigations implicate ration ingredients as the source of off-flavor and other subnormal quality characteristics in poultry as marketed. In one of these studies, cooperative with APH-ARS, roasting turkeys were graded fatter when fed high proportions of fish products in the ration and were downgraded more for predominant fishy off-flavors when the diet contained white fish meals than when sardine meal was used. The fatter the turkeys, the worse the fishy off-flavor. Linseed oilcake as a ration component resulted in more downgrading for off-flavors than did edible oilcake meals. In another study, cooperative with Fish and Wild Life Service, Department of Interior, the fishy off-flavors were reduced when chickens were cooked in ovens at 400° F. instead of 325° F. The use of an antioxidant (DPPD) in the poultry diet also was effective in decreasing the off-flavor. Nearing completion is another study cooperative with APH-ARS on the cooking and eating quality and cooked yield of turkeys of fryer-roaster size in relation to live and ready-to-cook weights when different kinds of protein, different levels of fat and different forms of added vitamins A and D were used in diets to accelerate growth.

Plans: During the year, attention will be given to flavor and cooking quality of slow-growing and fast-growing chickens, coop. APH-ARS

2. Predetermining the Cooking Quality of Rice HN

In order to predict the cooking quality of rice varieties before they are put into large-scale production and the quality of rices available for shipment to different consuming areas, an easily controlled cooking method has been developed and test procedures standardized, for use with small quantities such as are available to the geneticists. The method was pretested on 9 varieties of long, medium and short grain rices of known history and found to differentiate qualities such as cohesion, tenderness and starch characteristics, wanted for different consumer purposes, or suited to the food habits of different domestic and foreign groups. It is being further tested on 74 lots of rices from various geographic locations and of rices exposed to different drying and processing temperatures. Use of the method should aid in distributing and marketing rice, as well as in producing, varieties more adaptable to the needs of different rice consumer.

Plans: Analyses on the 74 lots will be completed and the work discontinued.

3. Quality of Pressure-Cooked Potatoes HN

The quality of pressure-cooked potatoes, studied under contract at Pennsylvania State University, was found to differ with the specific gravity and variety of potatoes. Sloughing and mealiness increased with specific gravity, but less sloughing resulted from sliced potatoes cooked a shorter time than from whole potatoes. Sliced samples of Chippewas and Katahdins were superior in color to whole tubers, but the reverse was true for Russet Burbanks, the most mealy of the varieties studied.

Plans: This study has been completed and no new work on potatoes is anticipated at this time.

4. Fruit Jellies with Added Pectin HN

Laboratory studies on jellied fruit products made with added fruit pectins have been carried out to develop ways to help conserve full-flavored ripe fruit, and to provide information for revising a favorite but out-of-date homemaker bulletin on jelly making. Eight kinds o fruit -- apples, blackberries, cherries, currants, grapes, peaches, plums and strawberries -- and five different pectins were studied. Liquid and powdered pectins from both apple and citrus sources were included. Storage tests up to 6 months showed that most fruit jellies change very little in firmness, and that color and flavor were retained better at refrigerator than at room temperatures.

Plans: This work has been completed and materials prepared for a technical bulletin, also for a revised homemaker bulletin.

5. Measurement of Food Quality HN

Recent progress in food quality measurements gives strength to many lines of research in this area. Measurements of food quality involve use of suitable physical, chemical, histological, sensory and statistical techniques. Improvements in some of these criteria are summarized below with only incidental reference to the commodity:

a. Physical procedures recently standardized for measuring food quality characteristics include the following: Use of a line-spread grid for recording consistency of apple sauce; use of wax models of potatoes to guide judges in rating degree of color, texture and sloughing; use of a specially constructed paddletester to measure resistance to turning as an index of jelly consistency; colorimetric determinations of starch loss in cooking water of rice as related to variety; and application of a number of new-types of equipment of precision meters for measuring quality characteristics.

b. Histological work in a study of quality of apples provided explanation for the break-down of skin and texture during storage and during cooking of baked apples; histological

techniques with cooked rices afforded explanation of results obtained from different methods of cooking and different rice varieties.

c. Statistical procedures are applied extensively in the design, conduct, and analysis of research in food quality. Both food specialists and statisticians have contributed to the planning and review of technical reports in statistical techniques for sensory testing of foods performed by the Virginia station under ARS contract. In Branch laboratories, designs developed for experimental work must be applicable throughout the sampling, experimental treatments and objective and palatability testing.

For palatability analyses, diverse statistical designs are required; adjustments are made as necessary to adapt conventional statistical designs to restrictions imposed by special problems connected with limitations in food samples, cooking procedures or taste testing. Since 1954, designs have been adapted and used for more than 30 experiments in palatability evaluation. For these, 13 were randomized block, 10 were lattice (partially balanced except one complete); the others included Latin square, Graeco-Latin square, Youder Square, and incompleted block and split block. Some of the restrictions imposed affect randomization, such as keeping quality of the food, the number of samples which can be served simultaneously as governed by taste fatigue, temperatures for judging, rates of cooking, order of dilution of dominant flavors.

d. Replications have been found essential in food quality research, not only in market lots, in cooking methods and sampling for analytical measurements, but also replication in season, crop year and locale of production, as well as among judging panels laboratory teams and in practical situations in household or restaurant kitchens. Various replications become especially important when the test is to serve as the basis for some national practice or regulation. In some instances the results are confirmed. For example, panels at the Connecticut Station and the Branch carried out tests simultaneously on poultry fed different fish meals and came up with identical answers as to levels of tolerance allowable in the ration. In other instances, the opposite is true. For example, during a study on potatoes from different locations for three consecutive crop years, some of the results obtained the first year were reversed or modified later due to different conditions of production. Also, minor adjustments were made in fruit jelly and jam formulas developed in the laboratory after evaluation of the products obtained by home-makers replicating these formulas, using their own kitchen and equipment after purchasing fruit in their own markets. Because of the importance of various replications, yield data

for vegetables procured in different regions and prepared in different institutions were considered of more value than replicate purchases from the same market prepared by the same person in the same kitchen or laboratory.

Plans: As opportunity permits, improvement in techniques will be sought in current lines of work on various commodities, and used whenever applicable in other reserach.

6. Effects of Pesticides on Food Quality and Flavor — ENT, ADP, DH, HN, HC

The production of marketable wholesome food is dependent upon the judicious use of a variety of potent insecticides. Their extensive use brings about new problems each year on residues and effects on quality and flavor. Therefore, continued research investigations are required to solve these problems as a part of the over-all program to develop safe and effective chemicals for controlling insects affecting plants and animals. The chief objective is commercial control of destructive insects without leaving injurious residues or adversely affecting the quality or flavor of crops or their products. The implementation of Public Law 518, including the establishment of tolerances for pesticide chemicals in or on raw agricultural commodities by the Food and Drug Administration, HEW, has greatly increased the demand for information on pesticide residues in or on foods, forage crops, animal products, and the soil. Tolerances are expressed as parts per million (ppm) and vary depending upon the toxicity of the insecticide and the extent to which different foods are consumed by people. After insecticide tolerances are set, any agricultural products in trade channels that exceed such tolerances are subject to seizure and condemnation. Much research on insecticide residues is required therefore before new materials can be recommended for insect control which will meet tolerances and guarantee wholesome and safe food to the consumer.

Research on insecticide residues is conducted by ENT at field stations located throughout the country, often in cooperation with state agricultural experiment stations, growers and insecticide manufacturers. Investigations at Beltsville, Maryland, are cooperative with ADP, DH, HN and HC.

a. Vegetables — ENT, HC, HN

HN conducted palatability evaluations to determine whether the flavor of sweetpotatoes, Irish potatoes, turnips, summer squash, and winter squash was affected by insecticides used in their production. No off-flavors were observed in sweetpotatoes following soil applications during growth of four different insecticides for control of sweetpotato weevils.

No flavor defects, attributable to insecticide treatments tested, were observed in Irish Cobbler or Cherokee potatoes or in turnips grown in soils treated with 3 or 6 pounds per acre of heptachlor; in mushrooms exposed to malathion spray or dust; or in summer squash (3 varieties) treated with lindane at a cummulative total application of 1.75 pounds per acre. Winter squash (2 varieties) trom plants treated with 1.75 pounds per acre of lindane were scored as having significantly more off-flavor than untreated squashes of the same varieties; however, no significant off-flavors were observed last year in winter squash following the same insecticide treatment.

In cooperative work with HC, off-flavors were found in carrots and turnips grown in soil treated in previous years with heavy applications of benzene hexachloride. No carry-over effects in carrots and turnips were found for chlordane, DDT (technical), dieldrin, marlate, TDE, and toxaphene. There was some indication that turnips might be affected following high level aldrin and heptachlor-treated crops.

Plans: On vegetables, to continue research on (1) the effects of the newer insecticides on plants and soils when used on various crops under a wide variety of conditions; (2) the effects of these insecticides on crop quality and flavor; (3) the problem of absorption by plants of insecticides, their translocation to edible parts of the plants and the possible formation of harmful degradation products; and (4) determining the quantities of insecticide residues remaining on edible parts of vegetables and other crops when insecticides are applied at various times during the development of these crops as a basis for making sound insect control recommendations.

b. Animal Products — ENT, ADP, DH, HN

One very important need is to determine the extent to which insecticides store in meat and milk when used on animals to control destructive insect pests or on forage which is fed to livestock. As new insecticides are tested for insect control, studies to determine hazards to the consuming public should be made simultaneously. Insecticides such as DDT, toxaphene, dieldrin, and aldrin cannot be used on dairy cattle since they are secreted in the milk. Other chlorinated hydrocarbon insecticides and the organic phosphorus insecticides show promise of less storage in both milk and fat of animals.

This research is conducted at Kerrville, Texas by ENT and ADP in fooperation with the Texas and Oklahoma Agricultural Experiment Stations, industrial concerns, and livestock growers. At Beltsville, Maryland, studies are carried out jointly by ENT, DH and HN.

Since methoxychlor is recommended for control of horn flies on cattle, it seems advisable to obtain more information on its excretion in milk when used on dairy animals. Two dairy herds were sprayed with 2 quarts of 0.5 percent methoxychlor per animal. Composite milk samples from each herd showed maximum residues averaging 0.17 to 0.11 ppm one to 3 days after treatment respectively. Samples taken 1 to 3 weeks after treatment averaged 0.04 to 0.01 ppm respectively.

Toxaphene applied to cattle provides excellent control of ticks, lice, and other pests. However, toxaphene was found to be excreted in the milk after spraying individual dairy cows with 0.5 percent suspensions and wettable powders. The amounts varied from 0.47 to 0.92 ppm during the first and second day after spraying. At 14 days the residues had decreased to an average of about 0.10 ppm.

Two cows were sprayed twice daily with one ounce of 2.0 percent toxaphene oil spray. They excreted an average of 0.41 ppm in the milk 3 days after spraying started. There was a slight decrease in residues during the ramainder of the 21-day period.

Toxaphene is also a useful insecticide for the control of several injurious insects on forage crops. It is important to know if this insecticide is excreted in milk when dairy cattle feed on treated rations. When toxaphene-treated feed was fed daily to dairy cows at dosages ranging from 20 to 140 ppm for an 8-week period, the insecticide was excreted in the milk at all dosage levels and at a rate of roughly 1 percent of the dosage given. One and two weeks after feeding ceased, the residue averaged 0.07 and 0.02 ppm at the 20 ppm feeding level.

Samples of fat, liver, and kidneys from pigs that had grazed for several months in pastures treated with granulated aldrin and dieldrin were analyzed. Small amounts of these materials (less than 1 ppm) were found in some of the samples.

In cooperation with industrial concerns, good progress has been made in developing or refining sensitive and reliable methods for measuring insecticidal residues in meat and milk. Refinements in methods have been developed for methoxychlor and toxaphene.

Plans: On animal products, to expand these cooperative studies because of the importance of determining the exact levels of different insecticidal residues in milk and meat. These data are required in order that toxicologists may ascertain whether or not the residues are excessive from the viewpoint of human health and entomologists must have it before making recommendations to growers on the use of different insecticides for the control of pests on food crops.

Publications HN

Cooking Quality and Palatability of Food

"The Effect of Moist and Dry Heat Cooking on Palatability Scores and Shear Force Values of Beef from Animals of Different Levels of Fleshing." S. Cover and M. C. Shrode. Jour. Home Econ. 47 (9): 681-685, Nov. 1955 (Contract with Texas)

"The Effect of Moist and Dry Heat Cooking on Vitamin Retention in Meat from Beef Animals of Different Levels of Fleshing." S. Cover and W. H. Smith, Jr. Food Research 21(2): 209-216, March-April 1956. (Contract with Texas)

"The Relationships Among the Age of the Animal, Carcass Grade, and Extent of Cooking with Certain Organoleptic, Chemical, Physical and Microscopic Characteristics of Beef Muscles." B. Lowe and J. Kastelic. Iowa Exp. Sta. Tech. Bul. (In press). (Contract with Iowa)

"Study of Three Cuts of Lower and Higher Grade Beef, Unfrozen and Frozen, Using Two Methods of Thawing and Two Methods of Braising." E. Fento, I. T. Flight, D. S. Robson, K. C. Beamer, and J. S. How. Cornell Expt. Sta. Mem. 341, March 1956. (Contract with Cornell)

"Effect of Cold Storage and Method of Cooking on Commercial Grade Cow Beef." P. Paul, M. Bean, and L. J. Bratzler, Mich. State Expt. Sta. Tech. Bul. 256, May 1956. (Contract with Mich.)

"Quality of Pressure-Cooked Potatoes." E. E. Hester and G. Bennett. Amer. Potato Jour, 33(5): 155-160, May 1956. (Contract with Pennsylvania)

"French Frying Quality of Potatoes as Influenced by Cooking Methods, Storage Conditions and Specific Gravity of Tubers." M. E. Kirkpatrick, P. H. Heinze, C. C. Craft, B. M. Mountjoy, and C. E. Falatko. Tech. Bul. No. 1142, March 1956. (Coop. with AMS)

"Cooking Quality and Flavor of Eggs, as Related to Candled Quality, Storage Conditions, and Other Factors." Agri. Inf. Bul. 164. (In press).

Food Preparation and Preservation HN

"Cooking Rice for School Lunches." O. M. Batcher, K. F. Helmintoller, and E. H. Dawson. Jour. Home Econ., 48(1); 36-37, Jan. 1956.

"Cooking White Rice." ARS 61-2, Aug. 1955. (Processed)

"Cooking With Dried Egg." Home and Garden Bul. 50. (In press).

"Get More Good From Milk." ARS 61-3, May 1956. (Processed).

"Home Canning of Fruits and Vegetables." Hone and Garden Bul. No. 8. (Revision, in press).

Effect of Agricultural Chemicals on Food Flavor HN

"Flavor Testa on Potatoes Grown in Soil Where Lindane Was Applied to Cucumbers." M. E. Cirkpatrick, G. S. Linton, B. M. Mountjoy, and L. C. Albright. Amer. Potato Jour. 32(7), 259-264, July 1955.

"Some Effects of Insecticide Spray Accumulation in Soil Upon Crop Plants." A. C Foster, V. R. Boswell, R. D. Chisholm, L. Koblitsky, R. H. Carter, G. L. Gilpin, B. B. Pepper, W. S. Anderson, and M. Gieger. Tech. Bul. 1149, Aug. 1956. (Coop with HC, ENT. N. J. and Miss.)

B. Proposals for Committee Consideration
(Order of Listing has no Priority Significance)

K. Quality and Safety of Re-Frozen Foods -- Initiate research to determine the effect of thawing and re-freezing on the quality and safety of frozen foods.

Investigations up to the present have been limited to studies of temperature changes occurring during periods of non-operation of home freezers. Users of home freezers require information on the effect of subsequent refreezing on the safety and quality of frozen foods. Samples of frozen foods typical of the various classes (fruits, fruit juice, vegetables, meats, and prepared foods) should be evaluated on the basis of bacteriological examinations of inoculated samples and both bacteriological and palatability tests on parallel uninoculated samples. Information is needed also regarding the safety of using prestuffed poultry, refrigerated or frozen, before cooking. (5/16)

L. Food Qualities Affected by New Methods of Cooking -- Initiate studies to determine the comparative effects of new and different methods of cooking on food qualities and nutritive values.

Such studies should include effects of rate, intensity and mode of heat application, such as effects of pressure cooking, electronic cooking, and other new processes available to institutional and household users. Information as to which foods, qualities and nutrients may be improved, and which may be damaged by some of the new methods of cooking is needed to guide household and institutionsl (including school lunch) managers and others responsible for food service. (8/16)

M. Evaluating Palatability -- Initiate research to develop and standardize more rapid, reliable, and reproducible laboratory methods and procedures for the sensory evaluation of food quality. Of greatest immediate importance is the establishment of a reference method for evaluating effect of pesticide residues on palatability, in order to standardize reliable procedures for inter-laboratory use.

The basic physiological, psychological, biochemical, and electrochemical reactions involved in sensory methods of evaluating food should be investigated, parallel with measures of physical, chemical, and histological attributes of foods, and palatability evaluations of color, flavor, and texture, and improved experimental designs and statistical procedures. The problem of measuring palatability is one of great concern to many groups, including producers, manufacturers of pesticides, food processors, and food service managers, as well as to consumers themselves.

Recurring problems in food quality require repeated use of analytical judging of palatability. For efficiency and precision in research progress, and for validity of results as a basis for programs of national action, it is important that procedures using subjective methods be standardized to give reproducible and consistent results in the hands of different workers. The need for uniform methods is becoming more acute, with increases in the number of chemicals used, foods affected, indication of carry-over effects in soil, and aggravating effects of processing. As conflicting reports from different laboratories are brought to bear on legislative action and regulatory programs, the validity of research results is challenged. Food industry journals have pointed out the ridiculous situation of lack of a common reference method for evaluating food flavor. Interested groups are regulatory agencies in Agriculture and in Food and Drug Administration who are faced with problems of conflicting and uncomparable data on which to base decisions, also research leaders in horticultural crops and animal husbandry concerned with crop protection.

HN has been asked to undertake research to establish a reference method for evaluationg effect of pesticide residues on palatability, cooperative with other interested groups in the Department and in the States, in the interest of food acceptability and consumer welfare in general and as a basic contribution to several technical committees now grappling with problems in palatability evaluation.

(Part of 10/16)

HOUSEHOLD ECONOMICS

I. HOUSEHOLD FOOD CONSUMPTION AND DIETARY LEVELS

A. PROGRESS ON WORK UNDER WAY

1. 1955 Food Consumption Survey — HHE, MD, SHR

The data on food consumption obtained from the 6,000 households included in the 1955 survey have been prepared for tabulation, a preliminary report has been issued and findings have been presented in Agricultural Outlook Charts, as well as in other publications. This is the first nationwide study of food consumption since 1942 that covers rural as well as urban households.

The preliminary tables from this survey indicate that food expenditures of housekeeping families in the U. S. averaged $27 a week in the spring of 1955. About $22 of this was for food consumed at home. With average size of the household at 3.43 persons, average expenditure per person amlunted to $7.89 a week for all food. Of this, $6.50 was spent for food to be prepared at home, and $1.39 for food consumed away from home. The tables included in this report also make possible comparison of rural and urban, regional, and income groups as to family food expenditures.

The food expenditure increase since the previous nationwide survey in 1942 indicates the effect of both higher food prices and the use of more expensive foods. In 1955, average food expenditure was about three times the average of $10 in 1942. A more precise comparison can be made for urban families of two or more persons. They spent $13 in 1942, $26 in 1948, and $32 in 1955. Food prices as measured by the Bureau of Labor Statistics' index advanced only 6.5 percent between 1948 and 1955. The fact that family food expenditures increased about 25 percent indicates what is sometimes referred to as "up-grading" of the diet--either use of more expensive types of foods or inclusion of more services, such as precooking of foods, in the foods purchased.

Plans: Five sets of initial reports are to be prepared and published in one Department publication series. These 5 are Food Consumption of Households; Dietary Levels; Home Food Preservation Practices; Home Food Production; and Home Baking Practices. Plans have been made for first releases in this series beginning lat in 1956. In all reports, separate data will be shown for each region and the U. S. for rural farm, rural nonfarm, urban, nonfarm (rural nonfarm and urban), and all urbanizations combined. In the processing of these data, the work has been planned to make the working materials (listings, punch cards, and tapes) as useful as possible also for later research that will require additional tabulations.

As soon as possible after the reports with basic data are issued, analytical and descriptive reports will be prepared by the agencies cooperating on this project. HHE-ARS will prepare materials on dietary adequacy, the relative economy of foods, the place of various foods in the household budget, and a study of the effect of various factors on household food practices as shown by the

proportion of expenditures for food away from home, the types of foods purchased for use at home and the types and quantities of foods produced; preserved, and baked at home, with regional-urbanization comparisons and trends over time.

SHR-AMS will prepare (1) a series of descriptive articles for the National Food Situation, (2) a series of commodity reports comparing the findings of this survey with those of other surveys, and with time series and other marketing data, and (3) a series of analytical cross-commodity reports, not yet outlined in detail.

Work is already in progress in MD-AMS on determining the relationship between income and consumption of major groups of foods based on individual family observations from this study. Household size as well as income is being taken into account in measuring the relationships. It is expected that this information will be useful to market analysts and others investigating patters of food consumption for the purpose of devising programs for promoting consumption of certain food products, and as an aid to lesislators in developing programs for subsidized consumption among low-income families of agricultural products in surplus supply.

2. Food Consumption and Dietary Levels of Rural Families HHE

Food consumption and dietary levels of rural families in the North Central region have been investigated as a basis for educational programs of teachers, nutritionists and extension workers and for policy and program decisions of USDA administrators and others interested in levels of living of rural families. The data were collected from a sample of 1,152 families in 1952. A report prepared for publication during the year summarizes the information on quantities and expenditures for food used during a week, the amounts that were purchased or home-produced, the nutritive content of the week's food and the variations in these respects among different groups of families. Some of the findings are summarized below.

Of every dollar spent for purchased food by the farm family, 22 cents went for meat, poultry, and fish, 20 cents for fruits and vegetables (including potatoes), 10 cents each for milk, baked goods, and beverages, 8 cents for fats and oils, and the remainder for sugar, flour, cereals, eggs and other foods.

Farm families with freezers or lockers used food in a week valued at retail prices of $7.26 per person, with 46 percent home-produced. The food they bought came to $3.76 per person. By contrast farm families without freezers or lockers had only 37 percent of their food (in money value) from the home farm. Their total food for the week had a retail value of $6.72 per person, $4.14 of which was purchased. Thus the farm families with freezing facilities produced more food for themselves and had more total food with less direct money outlay. They used more meat per person than families without freezing facilities. Although the families with freezing facilities used a little more frozen fruits and vegetables per person, frozen had not displaced fresh and canned products. Those with freezing

facilities used nearly the same amount canned and as much or more fresh as those with no facilities.

On the average, the food used at home by rural families in the North Central region provided diets exceeding the National Research Council's recommended allowances for calories and 8 nutrients studied, with the farm diets having larger amounts in relation to estimated need than the nonfarm. However, a number of families had diets low in one or more nutrients. One-fourth of both the farm and rural nonfarm diets fell below the NRC allowance for ascorbic acid; one-fifth of the farm and one-third of the nonfarm diets failed to meet the allowance for calcium. One-fourth of the nonfarm families were below the recommended level for thiamine and a fifth for vitamin A, riboflavin, or niacin.

In general, farm families had more food per person than nonfarm families, more than enough to make up for the greater food needs of farm households resulting from differences in degree of physical activity. One reason for this was the large amounts of home-produced food, particularly animal products, used by farm families. Most farm families in the North Central region produced milk, meat, or eggs for their own use, and families producing these foods consumed more of them than those depending solely on purchases.

Families with older homemakers were likely to have poorer diets than those with younger homemakers, especially when the family income was under $2,000. In this low-income group, 30 percent of the families with a homemaker aged 60 years or more had food in a week providing less than recommended amounts of protein, 46 percent of ascorbic acid, and 65 percent of calcium. These older low-income families are a significant group in the population. More than half of all the older rural nonfarm families (that is, families with a homemaker aged 60 or more) in the North Central region had an income below $2,000 for the year.

Plans: The two bulletins on this survey (one published and one described above in manuscript) complete the presentation of the basic data. Attention will be directed next toward estimating and interpreting trends in farm family food consumption.

e. Food Consumption and Losses in Four Institutions HHE

Very little has been known about the amount of food lost during preparation, cooking, service, and as plate waste in institutions. Yet if this loss is high, diets may not be nutritionally adequate and the cost of food will be unnecessarily great.

To acquire some information on what food issues and food losses are, the cooperation of 4 institutions--2 homes for aged and 2 for children--was obtained. In one children's home, the food was prepared and served in individual cottages with 15 children to a cottage. The other three institutions served from 90 to 804 persons. In each institution, food coming into the kitchen, the amount discarded during preparation and service, and the amount left on plates was

weighed to find out how much was eaten. Nutritive values and costs were then calculated.

The money value of food coming into the institution kitchen ranged from 56 to 83 cents per person per day. When adjusted for differences in calorie needs of the residents, three of the four had similar food costs. In these institutions, the money value per person of the food issued was approximately the same as or lower than that of food of low-income families in cities in the same region. The fourth institution, an institution for aged persons in the South, had considerably higher food costs.

The amount of food lost, especially as plate waste, in the three large institutions is probably larger than in a family situation. It amounted in value to 12 to 22 cents a person a day. On the other hand, food looses in the children's cottage ran less than 4 cents per child and may be similar to food losses in a large family where the food budget is small and plate waste held at a minimum.

When the average nutritive values of the foods as received were compared with the 1948 Recommended Dietary Allowances, all institutions were found to have adequate food supplies. When food losses were deducted, however, the food eaten in the two old-age institutions was low or border-line for several nutrients; iron in both institutions, vitamin A and niacin in one, and ascorbic acid in the other. The children's institution did better in meeting the allowances.

Plans: Publication of two articles completes current work in this area. The data will also be used by USDA food economists in assessing the adequacy of institutional diets and in formulating food plans. It has not been possible to initiate any new work in food losses in homes or institutions during the past year. (See proposal A which follows)

Publications

"Food Expenditures of Households in the United States." Preliminary Report, Household Food Consumption, 1955. August 1956.

"Food Expenditures, Preservation, and Home Production by Rural Families in the North Central Region," 1951-52." M. Orshansky, E. C. Blake, and M. A. Moss. Agr. Inf. Bul. 113. August 1956

"Food Preservation Practices and Relation to Income and Size of Family." M. Orshansky. In Rural Family Living, Nov. 1955.

"Food Preservation Practices and Relation to Age and Education of Homemaker." M. Orshansky. In Rural Family Living, Nov. 1955

"Effect of Food Losses on Nutritive Content of Diets in Four Institutions." C. L. Brine and E. B. Tate, Jour. Amer. Dietet. Assoc. 32, (1): 19-23 Jan. 1956

"Food Expenditures in Four Institutions." F. Clark and E. B. Tate. Jour. Amer. Dietet. Assoc., 32(9): 816-820. Sept. 1956.

"Nutritive Values of Per Capita Food Supply." In National Food Situation. 74, pp 5-6. Oct. 1955

"Nutrients Contributed by Major Food Groups--A Reflection of Changing Food Habits." E. Cofer. In National Food Situation, - 74, pp. 25-29. Nov. 1955.

B. PROPOSALS FOR COMMITTEE CONSIDERATION ON
I. HOUSEHOLD FOOD CONSUMPTION AND DIETARY LEVELS

(Order of listing has no priority significance)

A. Adjusted Estimates of Nutritive Value of Food Supplies -- Initiate research to obtain data on food waste in order to adjust estimates of nutritive value of national and family food supplies, for use in Department programs and in nutrition education.

Statistics on the nutritive value of national and family food supplies are widely used in Department programs such as those of ARS, AMS and the Cooperative Extension Service, and also by the public as an indication of dietary adequacy in the United States. Available statistics, however, are for food used in an economic sense (i.e., as it enters the kitchen) and do not provide a measure of the amounts of food eaten. Lack of information on the extent of the gap between estimates of nutrients in food supplies and the amounts actually consumed raises important questions in interpretation of findings as to the nutritive content of diets in this country. Data on food losses as they affect dietary adequacy are needed for nutrition education programs. For example, discussion of the increasing amount and changes in the kind of fat in the national diet, a matter of current concern to nutritionists, has emphasized the need for information on the extent of food losses in homes, restaurants and institutions. Moreover, judgments as to the potential market for foods in terms of dietary improvement could be markedly altered if statistics were available on the amounts of food actually consumed. Almost no data are now available from which to make any kind of estimate of household food losses. Although the staff recognizes the importance of this problem, it has not been possible within the current program to initiate the broad attack on this problem that would be needed to product meaningful results. (9/11)

B. Seasonality of Farm Family Diets -- Initiate research to determine the extent to which farm family diets differ with the seasons, for the interpretations of food consumption and dietary studies to nutrition education and Department programs.

Dietary surveys have usually been limited to one week, because of interview problems. Some seasonal data on which interpretations for the urban population were based were provided in 1948 surveys, but none are available for farm families. It is expected that seasonal differences in consumption of specific foods, in food expense, and in nutritive value of diets would be greater for farm than city families. (10/11)

C. Food Consumption of Family Members -- Initiate research on food consumption and nutrients content of diets of individuals to determine differences among age groups and the contribution to the total diet of foods consumed away from home.

Knowledge of food consumption of individuals of different age groups will contribute to the understanding and forecasting of changes in food needs and consumption as the age distribution of the population changes. This study would add to our very meager knowledge of the kinds and quantities of food consumed away from home and their importance in the total diet. Moreover, the usefulness of the household surveys would be greatly enhanced by quantitative data on consumption away from home by family members, as well as by data on the division of the food supply among family members. (New)

A. PROGRESS ON WORK UNDER WAY
II. DIET APPRAISAL

1. Basic data for Food and Nutrition Programs HHE

Research findings from several projects have been used in the development of a publication, Essentials of an Adequate Diet, released in June 1956. The most recent research on human nutritional needs (expressed in terms of recommended dietary allowances), nutritive value of foods, and food consumption habits provides the basis of the recommendations contained in the bulletin. Special emphasis has been given to the nutrients most likely to be short in U. S. diets, and to foods that are good sources of these nutrients. Because different kinds of foods can provide the essential nutrients and because food supplies in this country are ample to provide considerable freedome of choice, the bulletin presents a point system to show how common foods rate as sources of key nutrients. Using this system, foods within the basic plan can be inter-changed to allow for differences in availability and cost of foods, food preferences, and other factors.

This publication was designed as a source book for home economists and nutritionists, in extension and other fields, who are teaching the principles of good food selection. It is the first of a series, Facts for Nutrition Programs, designed to meet the continuing demand for authentic information on food values, diets, and other subjects related to nutrition.

Plans: This series will be expanded to cover additional topics, and in cooperation with information and education specialists of popular materials and teaching aids will be prepared to present the information contained in "Essentials of an Adequate Diet."

2. Facts for Consumer Education HHE

Another series of publications, Facts for Consumer Education, presents basic research material, by commodity, on consumer buying, nutritive values and use of foods, for use in consumer information and marketing programs. This series has now covered the following foods: Beef, pork, tomatoes, peaches, milk and milk products, and bread. The publication on bread which was issued during the year was especially well received.

Plans: A publication on potatoes is in clearance. At present, no additions to the series are planned.

3. Composition and Nutritive Value of Foods HHE

Continuing work is required to prepare and keep up to date suitable tables of the composition and nutritive value of foods. One of the segments completed during the year was a handbook on physical yields and losses or changes that occur in food preparation. Information has been brought together from many laboratories on how much meat, fruits, vegetables and other foods purchased on the market can be expected to yield as food ready to eat. The publication "Food Yields--Summarized by Different Stages of Preparation" gives dietitians and food managers an up-to-date guide for planning food purchases for school lunch rooms, hotels, restaurants, the armed forces, hospitals, and other institutions. The data take account of present-day practices in processing and marketing food and new developments in breeding plants and livestock that affect yields not reflected in earlier less comprehensive summaries of yield data.

Preliminary tables of amino acid content of food were issued in small edition for study and review. Included were values for 12 amino acids for over 300 food items. This is the first comprehensive table of average values available for calculating the amino acid content of diets or food supplies. In preparation for publication, data for 6 more amino acids and several additional food items are included.

Plans: Progress is being made in establishing channels for securing unpublished analytical data to use in a contemplated revision of Agriculture Handbook 8, "Composition of Foods, Raw, Processed, Prepared."

4. Contribution to Food and Nutrition Programs HHE

Nutrition Committee News, issued bi-monthly to members of State Nutrition Committees and other nutrition workers, has continued to summarize and interpret research findings and to promote exchange of information about nutrition activities. Included during the year was a round-up of nutrition activities of public health agencies, prepared by nutritionists in the Public Health Service and Children's Bureau of the Department of Health, Education and Welfare; a summary of progress in the school lunch and school milk programs, prepared by the Food Distribution Division of Agricultural Marketing Service; and a history of West Virginia's State Nutrition Council prepared by members of that group. One issue covered research reporting on diets and nutritional health of adulsts. For another issue programs of the Nutrition Committees designed to promote improvement were described and summarized.

Another contribution to nutrition programs is a publication describing briefly the nutrition education and school lunch activities of Federal agencies, as well as the American National Red Cross and the Food and Agricultural Organization of the United Nations. Issued by the Agricultural Research Service in May 1956, this pamphlet was prepared by the Interagency Committee on Nutrition Education and School Lunch for

use with students and out-of-country visitors as a guide to sources of information on nutrition education and school lunch.

Plans: The activities of the Nutrition Programs Service will be continued. Plans are being developed for a Nutrition Institute during 1957, to be sponsored by the Department of Agriculture and other agencies concerned with nutrition and nutrition education.

Publications

"Essentials of an Adequate Diet--Facts for Nutrition Programs. L. Page and E. F. Phipard. ARS 62-4, June 1956. (Processed)

"Diet and Serum Cholesterol in Men: Lack of Effect of Dietary Cholesterol." A. Keys, J. T. Anderson, O. Mickelsen, S. F. Adelson, and F. Fidanza. Jour. Nutr. 59(1) 39-56. May 1956.

"Bread, Facts for Consumer Education." I. H. Wolgamot and L. J. Fincher, Agr. Inf. Bul.-142. Nov. 1955.

"Food Yields--Summarized by Different Stages of Preparation." R. K. Pecot and B. K. Watt. Agr. Handbook-102. Jul. 1956

"Nutrition Committee News"(5 issues):

"Cooperation Sparks Success in School Lunch, School Milk, July-August 1955."

"Nutrition Programs of Public Health Agencies, September-October 1955."

"Adult Nutrition I. The Situation, Winter 1955-56, November-February."

"The History of West Virginia's State Nutrition Council, March-April 1956."

"Adult Nutrition II. Practical, Popular Nutrition Programs, May-June 1956."

"Nutrition Education and School Lunch Activities of Agencies Represented on the Interagency Committee on Nutrition Education and School Lunch, Prepared by the Interagency Committee." ARS 62-3, May 1956. (Processed)

B. PROPOSALS FOR COMMITTEE CONSIDERATION ON
II. DIET APPRAISAL

(Order of listing has no priority significance)

D. Food Composition Tables -- Expand research to increase the scope of tables of composition and nutritive value of foods.

The tables of food composition published by the U. S. Department of Agriculture at intervals since 1896 are the basic source of data on nutritive value of foods and are used throughout the country in appraising the place of foods in diets and for food planning. They are widely reproduced in textbooks used in nutrition teaching. Practical applications in the Department include evaluating the nutrient content of foods for dietary surveys, the per capita food supply and for the school lunch program, and in providing consumer information for nutrition education and marketing programs. The basic tables must be revised at intervals to include new laboratory data on the nutritive value of foods and to keep abreast of new foods and changes in foods available on the market. A limited revision of the basic handbook has been initiated, but because of the large number of new foods on the market and the wealth of new data among public and private laboratories throughout the country, it is not possible to cover the field adequately without an expanded program. The expanded program would make it possible to increase the number of foods and varieties of foods covered, to increase the number of nutrients for which data will be summarized. (New)

E. Facts for Nutrition Programs -- Expand the series "Facts for Nutrition Programs" to include research findings on food and nutrition that will be useful in nutrition programs.

The first publication in this series, "Essentials of an Adequate Diet," has made research findings available on which to base popular releases, visual material and nutrition education programs. Additional topics that should be covered are: The relative economy of various types of foods as sources of nutrients; food in relation to weight control; food fads and misinformation; and information about food processing, food handling practices, and additives as they affect the wholesomeness and nutritive value of foods. (New)

III. FAMILY EXPENDITURES AND HOUSEHOLD MANAGEMENT

A. Progress on Work Under Way

1. Farm family spending patterns in 1955 — AMS, HHE

Collection of data from a national sample of approximately 3,950 farm operator families on family living expenditures was completed in the spring of 1956, and tabulations will shortly be available. This survey is part of a larger undertaking, which includes also farm production expenses, initiated to provide weights for a revision of the Parity Index and to improve income statistics. The Agricultural Marketing Service and the Bureau of the Census have obtained and tabulated the data, with assistance from HHE in developing the family living interview schedule and in obtaining and tabulating the data on family living expenditures.

Plans: Tabulations of the family living data, with some regional classification, will be published. In addition, tabulations and analyses will be prepared for the revision of "Guiding Family Spending," a publication which has been widely distributed and for which there are still numerous requests. Last year the publication was allowed to go out of print because the data used in the illustrative tables were obsolete and insufficient current data were available for revision.

2. Budget Guides — HHE

Progress has been made in obtaining some of the basic data needed for the revision of the publication "Guiding Family Spending." (See above.)

A start has also been made toward estimating the average service life of durable household equipment, as used in households. This is a key question in developing family budget guides, and tables of average expenditures of families are less useful for this than for any other part of the family budget. Using data from earlier surveys, a method has been developed for estimating average expected use life of such equipment, adapting actuarial techniques used by life insurance companies in computing insurance rates and by many industrial firms in computing charges for depreciation on equipment. The method has been tested on findings from a pilot study and arrangements completed for collection of data on 4 pieces of equipment from some 17,500 households by the Bureau of the Census.

Plans: The assembly of tabulations and analyses needed for publications to meet the needs formerly served by "Guiding Family Spending" will continue. The Census collection of data on age distribution of 4 pieces of equipment will be undertaken in the spring of 1957, and some tables should be ready within a year.

3. Alternative Uses of Time and Money HHE, CH

To assist families in the management of money, time, and other resources, HHE and CH in a joint project, have been developing procedures for determining money savings and time costs of homemade clothing. This is one of several lines of work being explored to determine if improved methods can be developed to assist families in assessing the alternative uses of time and money in the home. For example, a preliminary report on methods of estimating savings from home production of milk is being made available to Extension home economists through the publication Rural Family Living and some exploratory work on home baking is under way.

Home production has long been regarded as a way in which the homemaker can contribute to the family's non-money income. However, with increasing manufacturing efficiency, the economies of large-scale production, and continued technological development, many home economists are questioning whether or not savings through home production are still possible. Furthermore, if savings are possible, which items can a homemaker most profitably spend her limited time on?

The decision is, in the end, necessarily an individual one, depending largely upon the skill of the homemaker. However, research can bring to the fore the considerations necessary in making such decisions, and findings from laboratory experiments and from home situations, can provide background information for the decision by the individual homemaker.

The home sewing project was started with cotton housedresses, one of the garments that family surveys have shown are most frequently made at home, and garments similar in style and construction to garments purchased ready-to-wear were made in the laboratories under conditions roughly comparable to those encountered in homes. The project was later extended to cotton street dresses and children's cotton dresses.

Under the conditions of these experiments, money savings were effected in all instances, and, for most of the garments, the savings were substantial in terms of time spent. For example, the money savings of 5 styles of cotton street dresses in size 14, made from commercial patterns, was $24.55 with a total time spent in making the garments of 14.3 hours. The money savings of 5 styles of children's dresses (in size 8) were $11.09 and the total time spent was 9.6 hours. The money savings on house dresses was considerably less. These experiments suggest that the savings are greater on the higher-priced garments. However, the more costly garments in a wardrobe are likely to be those requiring more skill in making. A homemaker's lack of skill may limit her potential savings from home sewing.

Plans: It is planned to bring together the available information on money savings and time costs for the use of home economists and as a basis for considering the next steps to be taken. No further laboratory work is planned on time costs of home sewing at the present time. (See proposals "F" and "G".)

4. Outlook and Rural Family Living HHE

The program in this field has continued, supplying 4 issues of the publication Rural Family Living, contributing to Agricultural Outlook Charts, and providing participation in the annual Agricultural Outlook Conference and in other workshops.

For the 1956 Agricultural Outlook Chart Book prepared cooperatively by ARS and AMS, HHE contributed 13 charts on the following subjects: Proportion of farm operators working 100 or more days off home farm; proportion of wives in labor force; food consumption of North Central farmers; farm diets need improvement; prices paid by farmers for family living; prices paid by urban consumers for selected items; percent of farms with running water, television, and home freezers.

Data were compiled on value of household inventories on farms and on farm family expenditures for inclusion in such publications as the Balance Sheet of Agriculture, The Federal Reserve Bulletin, and Agricultural Statistics. Staff participated in workshops on Family Financial Management and Resource-Use Education at University of Tennessee and North Carolina College.

Plans: Continuation of this program at the same level is proposed.

Publications

"Family Clothing Inventories and Purchases...With an Analysis to Show Factors Affecting Consumption". M. L. Brew, R. R. O'Leary and L. C. Dean. Agr. Inf. Bul. 148. April 1956.

"Rural Family Living": Oct. 1955, 24 pp.; Dec. 1955, 33 pp.; Apr. 1956, 28 pp.; Aug. 1956, 21 pp. (Processed)

"Agricultural Outlook Charts." (Chartbook) Prepared for the 1956 Outlook Conference. Nov. 1955. (Coop with AMS)

"Farm Family Living." Paper presented by M. L. Brew at 1956 Agri. Outlook Conference, Nov. 1955. (processed).

"Estimating Money Savings and Time Costs of Homemade Cotton Dresses," Paper presented by M. L. Brew at 1956 Agri. Outlook Conference, Nov. 1955 (processed).

"Estimating the Service Life of Household Goods by Actuarial Methods." J. L. Pennock and C. M. Jaeger. Jour. Amer. Statisti. Assoc. (In press).

B. Proposals for Committee Consideration
(Order of Listing does not Indicate Priority Significance)

F. Budget Guides -- Expand research to analyze and interpret available data on family income and expenditures for food, clothing, housing, equipment, furnishing, etc., to develop family budget guides needed by home economists engaged in teaching, family counseling, social welfare and Extension work.

Research findings on family financial management are needed by home economists and others who counsel with families and who develop home economics programs for secondary and adult education, social service administration and other purposes. The farm and home unit approach under way in Extension programs throughout the country and the Rural Development Program have intensified the need for data for farm-operator families. The Extension Service is also increasingly serving city and village families. The importance of having research-based family financial plans available for all population groups has long been emphasized. Data on urban family expenditures collected by the Bureau of Labor Statistics for 1950 and data from the Agricultural Marketing Service 1956 survey of farm-operator families, if supplemented by reports from rural nonfarm families (see following proposal), would provide the base for this undertaking. Additional analyses would be required for developing budget guides, supplemented by small-scale studies of special problems in budget guides, supplemented by small-scale studies of special problems in budgeting family resources. (3/11)

G. Rural Nonfarm Family Spending Patterns -- Expand research on family spending patterns to obtain data for the rural nonfarm population, to use in providing family budget guides for all population groups.

The Agricultural Marketing Service, with technical assistance from home economists of the Agricultural Research Service, has just completed collection of data on farm-operator family expenditures for the year 1955. A national survey of urban family living expenditures was made by the Department of Labor for the year 1950. New comparable data should be collected for rural nonfarm families. Data from these three major sources need to be brought together with data from supplementary sources (for example, replacement rates of durable goods), analyzed, and interpreted. Rural nonfarm families are an important population group that cannot be included in the research on family financial planning unless these basic data are obtained. (6/11)

H. Household Inventories -- Expand research on inventories of household equipment and furnishings by extending the items inventoried in the dwelling unit and by surveying other areas, including a rural one.

For budget guidance work, as carried on by the Extension Service, social workers, and family counselors, there is need for information on the cost of furnishing a home and on the rates and methods of acquisition of inventory. In estimating living costs and evaluating levels of living for the Rural Development Program, data on inventories are needed, especially for comparison of full-time farm, part-time farm, and rural nonfarm families. Moreover, the estimate of the aggregate value of farm household inventories, calculated periodically for the Balance Sheet of Agriculture by home economics research staff, is based on a 1940 estimate and should be improved, in view of the wide use that is made of it. A recent pilot study has demonstrated the feasibility of obtaining data of this nature from households and of increasing the scope of the inventory without unduly extending the interview. (New)

I. Savings from Home Production -- Expand research on guidelines for estimating the costs and money savings to be considered in choosing between home production and purchase of goods needed for family living.

Questions are frequently raised as to the net gain families realize from gardens or home production of milk. Similar questions could be raised about other kinds of home production -- baking, canning, sewing and other tasks. These have recently been emphasized in connection with the Rural Development Program. Such research is probably most fruitful in cooperation with the States, because prices, markets and opportunities for home production may vary from one region to another. A variety of products should be considered, in order to provide the comparisons needed by the modern homemaker in the allocation of her time. (New)

J. Employment-related Expenditures of Wives Working Outside the Home -- Initiate research on the effect of employment of wives on family expenditures.

Census reports show that employment of wives is increasing. Little information is available as to the effect of such employment on family budgeting and money management, although Extension workers, teachers, and others who counsel with families are concerned. For example, it is evident that not all the wife's earnings represent clear financial gain. One aspect of the study of her contribution, therefore, is a determination of expenditures resulting from or occasioned by her employment; i.e., the amount of the expenditures that would not otherwise be made and the changes in the usual expenditures.

Some data that contribute to this subject are already available from other studies. A study of family clothing inventories and purchases in Minneapolis-St. Paul and in Meeker and Wright Counties, Minnesota, and in Birmingham, Alabama, provides comparisons of clothing expenditures by working and non-working wives. Food buying practices of

employed women are described in several recent studies. Further exploratory analysis would be made of these and other data, as a preliminary step toward setting up a survey directed more specifically toward the problem as a whole. (New)

SUMMARY OF PROPOSALS FOR COMMITTEE CONSIDERATION

I. TEXTILES AND CLOTHING

A. Improved Methods to Determine Fabric Serviceability -- Expand research to develop improved methods for determining fabric serviceability.

B. Improved Dimensional Stability and Elastic Properties of Knit Fabrics -- Expand research such as has been done on constructions of plain knit and two-bar tricot fabrics in relation to functional properties to include other commonly used types of knit fabrice such as interlock, raschel and milanese.

C. Fabric Construction in Relation to Serviceability of Shirting Fabrics -- Expand research to determine the effect of yarn and fabric construction upon the properties and performance-in-use of cotton shirtings.

D. Fabric Construction in Relation to Serviceability of Floor Coverings -- Expand the present study of serviceability of floor coverings (now limited to cotton broadloom) to determine the reaction to in-service wear and professional cleaning of tufted wool floor coverings, made from varying amounts of wool blended with scarce classical wools commonly used by manufacturers of floor coverings.

E. Physiological Requirements of Clothing -- Expand research to determine the effect of fabric composition and structure, clothing design and construction on comfort and function.

F. Sizing and Serviceability of Shoes -- Initiate research on foot measurements essential to the improved sizing of shoes an and on factors essential to shoe serviceability.

G. Clothing for Children -- Initiate research to develop functional clothes for pre-school children.

H. Launderability of Present-day Fabrics -- Expand research to evaluate the effect of various cleaning procedures on the properties of currently available fabrics as a basis for recommending acceptable methods for home laundering.

I. Home Applied Finishes for Fabrics -- Initiate research on applied finishes such as starches, plastic finishes, softeners, soil retardants, and antistatics, for improving the appearance, hand, comfort, and ease of care of clothing and household testiles.

J. Prevention and Removal of Discoloration of Fabrics in Use-- Expand research to determine the cause, and methods for prevention, of discoloration that occurs in fabrics manufactured from cotton and man-made fibers.

II. HOUSING AND HOUSEHOLD EQUIPMENT

A. Performance Requirements of Hand Irons -- Initiate research to determine satisfactory ironing temperatures and to develop laboratory methods for predicting the performance-in-use of hand irons.

B. Automatic Temperature Controlled Surface Unit -- Initiate research to determine operating characteristics and performane requirements of thermostatically controlled surface units and burners as a basis for recommending satisfactory procedures for their use.

C. Electronic Range Cooking -- Initiate study of performance-in-use of the hourshold electronic range.

D. Air Conditioning in the Home -- Initiate exploratory research on the enviormmental conditions resulting from air conditioning in homes and their effect upon various aspects of family living and household management.

E. Effectiveness of Cold Water Rinsing -- Initiate research to determine whether cold water is as effective as warm rinsing of detergent solutions from fabrics during the laundering process.

F. Laundering Procedures to Reduce Discoloration -- Expand research on use of modern laundering equipment to determine procedures which will remove the constituents of soil that cause discoloration in naturally soiled fabrics from cotton and man-made fibers.

G. Farm Household Water Requirements -- Initiate research to determine total volume and peak water requirements for the farm household to provide information needed for recommendations regarding water supply, plumbing systems, and waste disposal facilities.

H. Functional House Plans -- Expand work on development and evaluation of functional farm house plans incorporating recent State-Federal coordinated housing program.

I. Materials and Finishes for Walls, Table Tops and Floor Coverings for Kitchens and Workrooms -- Initiate research to make available comprehensive information on performance of different types of materials for wall, work counter and floor coverings for kitchens, workrooms and bathrooms.

J. Lighting Requirements for Household Activities -- Initiate analytical work on lighting requirements as a basis for a reference source of home lighting needs.

III. FOOD AND NUTRITION

A. Carbohydrates in Foods -- Linitiate laboratory analyses on carbohydrates in foods to replace inadequate or obsolete data likely to give erroneous results in diet planning and appraisal.

B. Organic Acids in Foods -- Initiate laboratory analyses to determine the kinds and quantities of various organic acids in fruits and vegetables.

C. Fatty Acids and Other Lipids in Foods -- Expand research to obtain more comprehensive data on fatty acids and other lipid fractions in foods.

D. Nutritive Value of Poultry Products -- Expand research to provide improved data on the nutritive value of poultry in forms as commonly processed for the table.

E. Fat in Nutrition -- Initiate research to investigate the role of fat in human nutrition, such as the relationship of the amount and kinds of fat to metabolism of other nutrients, determination of desirable upper and lower limits of fat intake in the various nutritional situations, the physiological effect of fat artifacts arising from modern food processing, and the dietary precautions needed when different types of fat in diets are unusually high or low.

F. Physiological Availability of Nutrients from Foods -- Expand research to determine the physiological availability of various nutrients from different foods, and the extent to which food processing, other food constituents and diet patterns affect their availability.

G. Factors that Affect the Food Consumption of Children -- Initiate research on children's acceptance of important kinds, forms and combinations of food and of factors that influence their food consumption as a basis for determining how desirable food habits can be developed.

H. Dietary Factors Affecting Amino Acid Requirements -- Expand research on the effect of type of carbohydrate in the diet on amino acid utilization to include other components of diet, and other biochemical and physical criteria of the nutritional effects.

I. Fatty Acid Requirements of Various Age Groups -- Initiate research to determine the requirements of various age groups for the long-chain "essential" fatty acids, with particular attention to adolescents, and to adults.

J. Nutritional Requirements for Newer B-vitamins -- Initiate research to determine human requirements for pyridoxine, pantothenic acid, folic acid and related B vitamins, in normal young adults.

K. Quality and Safety of Re-Frozen Foods -- Initiate research to determine the effect of thawing and re-freezing on the quality and safety of frozen foods.

L. Food Qualities Affected by New Methods of Cooking -- Initiate studies to determine the comparative effects of new and different methods of cooking on food qualities and nutritive values.

M. Evaluating Palatability -- Initiate research to develop and standardize more rapid, reliable, and reproducible laboratory methods and procedures for the sensory evaluation of food quality. Of greatest immediate importance is the establishment of a reference method for evaluating of pesticide residues on palatability, in order to standardize reliable procedures for inter-laboratory use.

IV. HOUSEHOLD ECONOMICS

A. Adjusted Estimates of Nutritive Value of Food Supplies -- Initiate research to obtain data on food waste in order to adjust estimates of nutritive value of national and family food supplies, for use in Department programs and in nutrition education.

B. Seasonality of Farm Family Diets -- Initiate research to determine the extent to which farm family diets differ with the seasons, for the interpretations of food consumption and dietary studies to nutrition education and Department programs.

C. Food Consumption of Family Members -- Initiate research on food consumption and nutrients content of diets of individuals to determine differences among age groups and the contribution to the total diet of foods consumed away from home.

D. Food Composition Tables -- Expand research to increase the scope of tables of composition and nutritive value of foods.

E. Facts for Nutrition Programs -- Expand the series "Facts for Nutrition Programs" to include research findings on food and nutrition that will be useful in nutrition programs.

F. Budget Guides -- Expand research to analyze and interpret available data on family income and expenditures for food, clothing, housing, equipment, furnishing, etc., to develop family budget guides needed by home economists engaged in teaching, family counseling, social welfare and Extension work.

G. Rural Nonfarm Family Spending Patterns -- Expand research on family spending patterns to obtain data for the rural nonfarm population, to use in providing family budget guides for all population groups.

H. Household Inventories -- Expand research on inventories of household equipment and furnishings by extending the items inventoried in the dwelling unit and by surveying other areas, including a rural one.

I. Savings from Home Production -- Expand research on guidelines for estimating the costs and money savings to be considered in shoosing between home production and purchase of goods needed for family living.

J. Employment-related Expenditures of Wives Working Outside the Home -- Initiate research on the effect of employment of wives on family expenditures